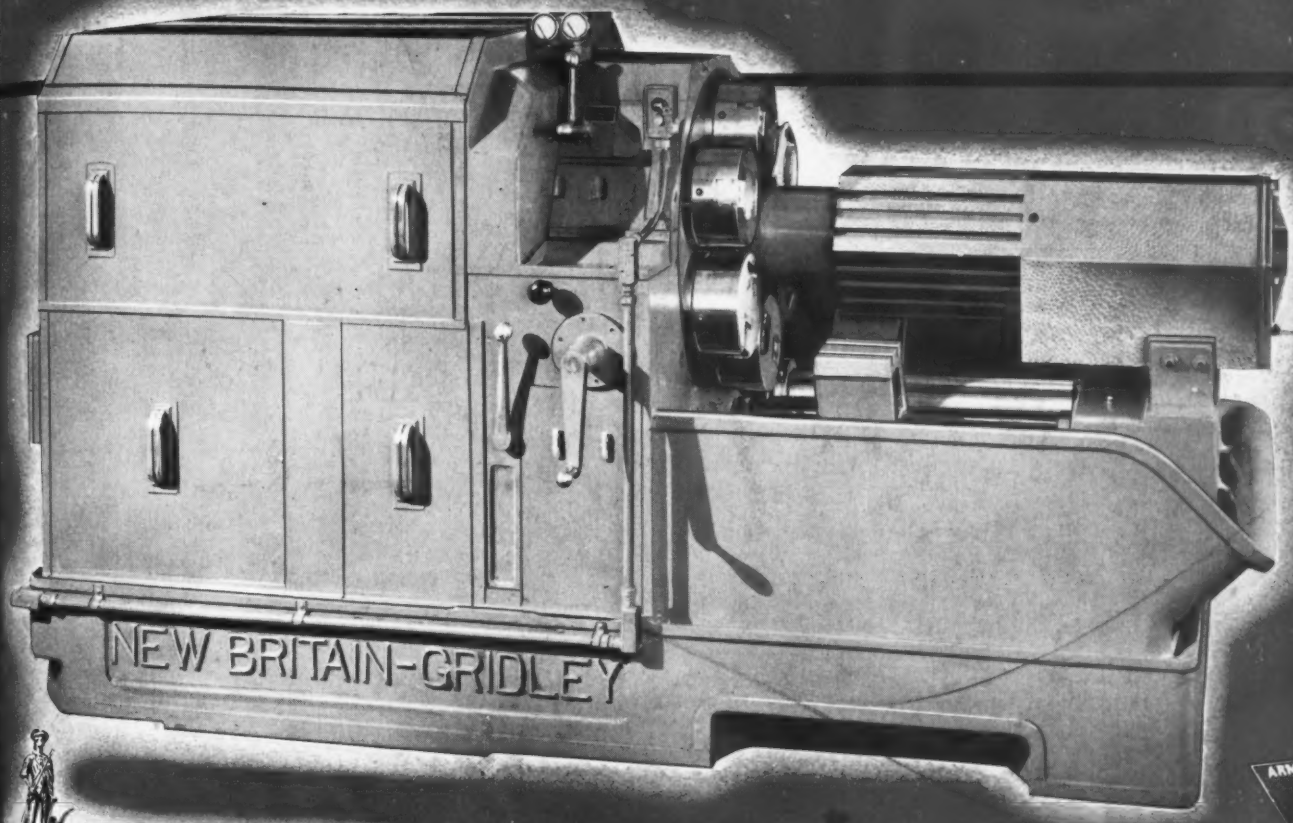
JUNE 1944 • FIFTIETH YEAR

MACHINERY



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MACHINERY

JUNE, 1944

The phenomenal production levels attained by the aircraft industry during the last year reflect directly the progressiveness of the engineers and production executives in plane factories. New manufacturing methods are constantly being developed by these men to maintain the unbelievably high rates of output, in spite of product changes and loss of skilled personnel to the armed services. Some of these recently developed methods will be described in July MACHINERY—the first section of the seventh annual Aircraft Production number, which will deal specifically with operations in plane-building plants. The continuation of the Aircraft Production Section, in August MACHINERY, will describe important developments in engine, propeller, and instrument manufacturing plants.

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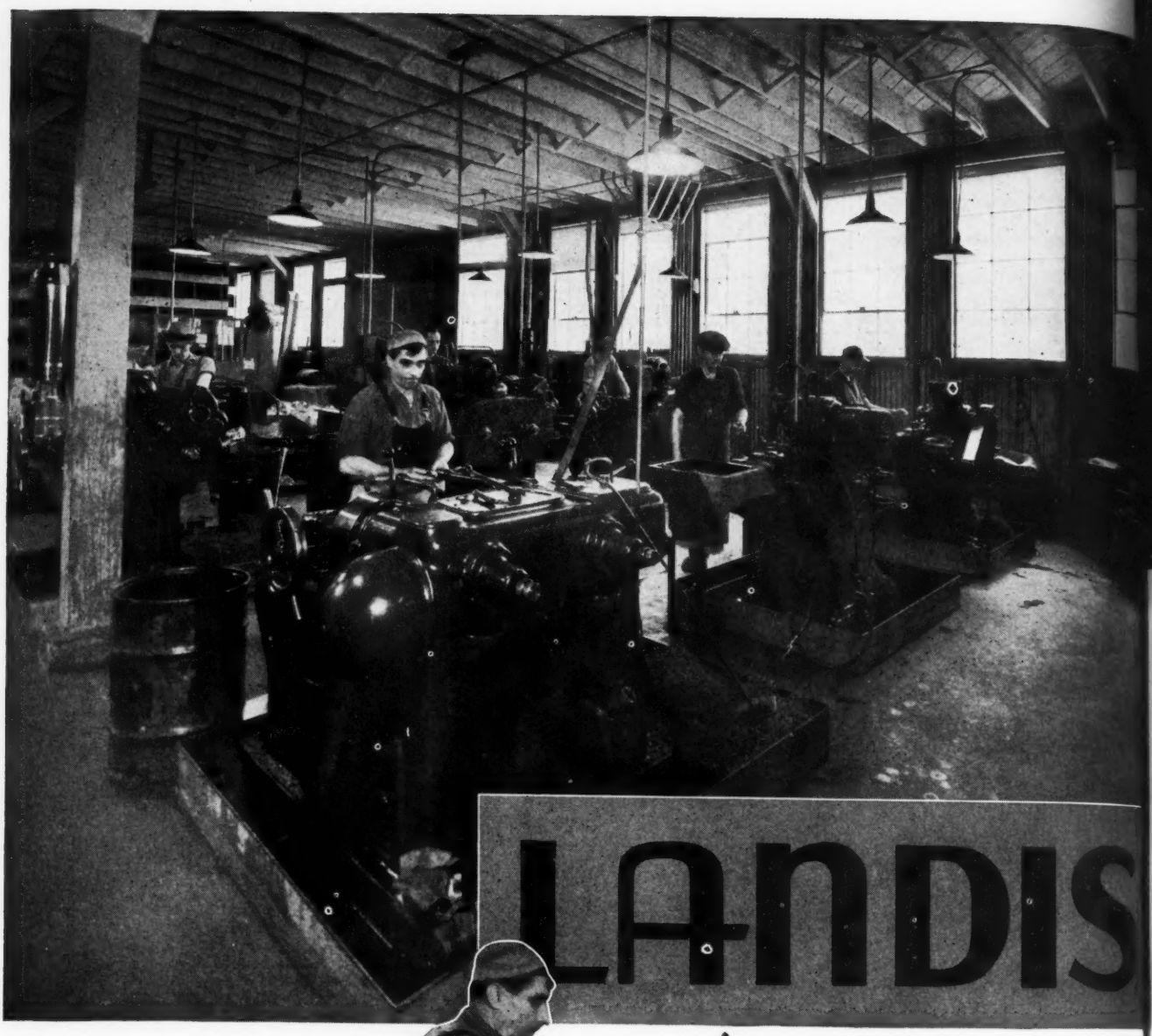
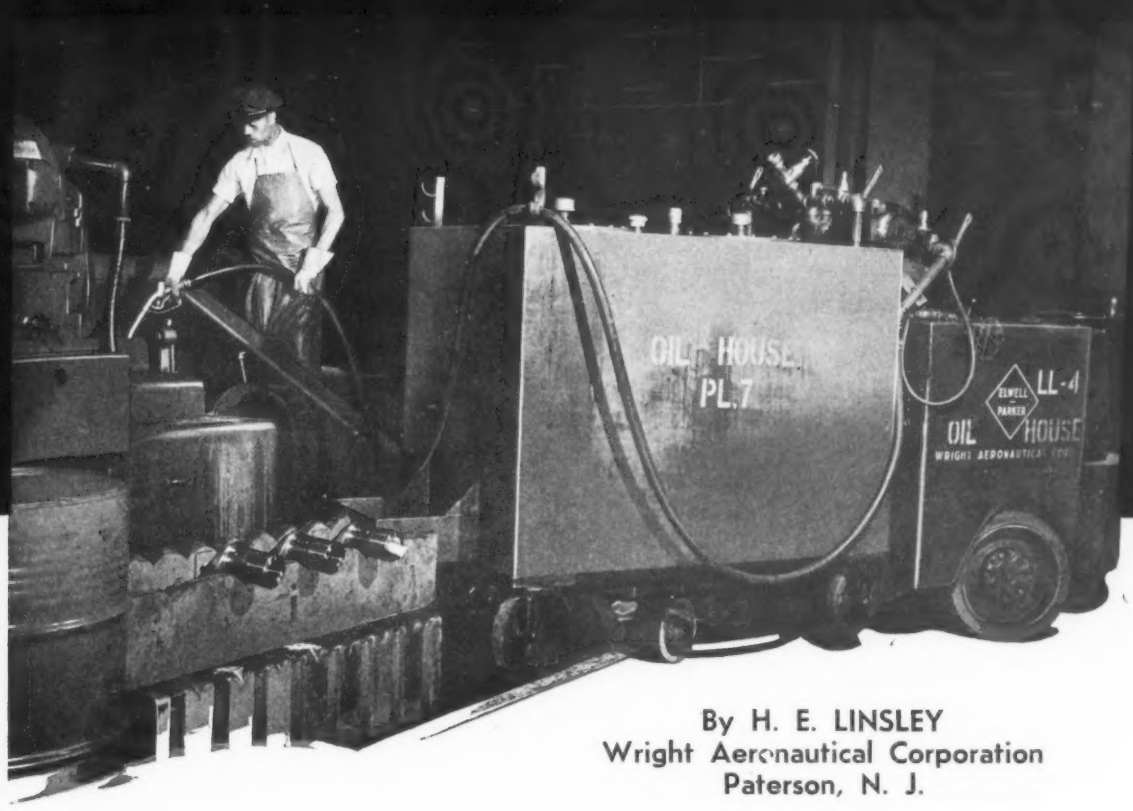


Landis Pipe and Nipple Threading Machines are used exclusively in this west coast installation. Illustrative of the production obtained, a 1-1¼" LANDMACO Machine averages daily 300 space nipples per hour, ¾ inch pipe size, and maintains an average of from 3000 to 5000 threads per grind of the chasers.



By H. E. LINSLEY
Wright Aeronautical Corporation
Paterson, N. J.

Oil Salvage Promotes War Economy

Lubricating and Cutting Oils and Cleaning Solvents are Among the So-Called "Critical Materials." This Article Describes Equipment Installed for Reclaiming Such Oils in the Interests of War Economy. The Annual Savings Derived from This Equipment Approach One Million Dollars

THE salvage of scrap metals in the interests of war economy has been organized on a nation-wide basis, and factory executives are familiar with efficient procedure so far as metal salvage is concerned. Less well known, however, are the methods by which certain other materials are salvaged—materials that, in many cases, are even more critical than aluminum, steel, or brass, and are equally urgently needed in war production.

The Wright Aeronautical Corporation, for example, uses great quantities of Stoddard solvent for washing engine parts, and it is essential that this solvent be free from an excessive amount of dirt and foreign matter. Much of it is used in spray booths, from which it is removed after a short period of use, but a substantial quantity of the solvent is contained in small open tanks located beside machines. The solvent supplied for the open tanks is blended with a cor-

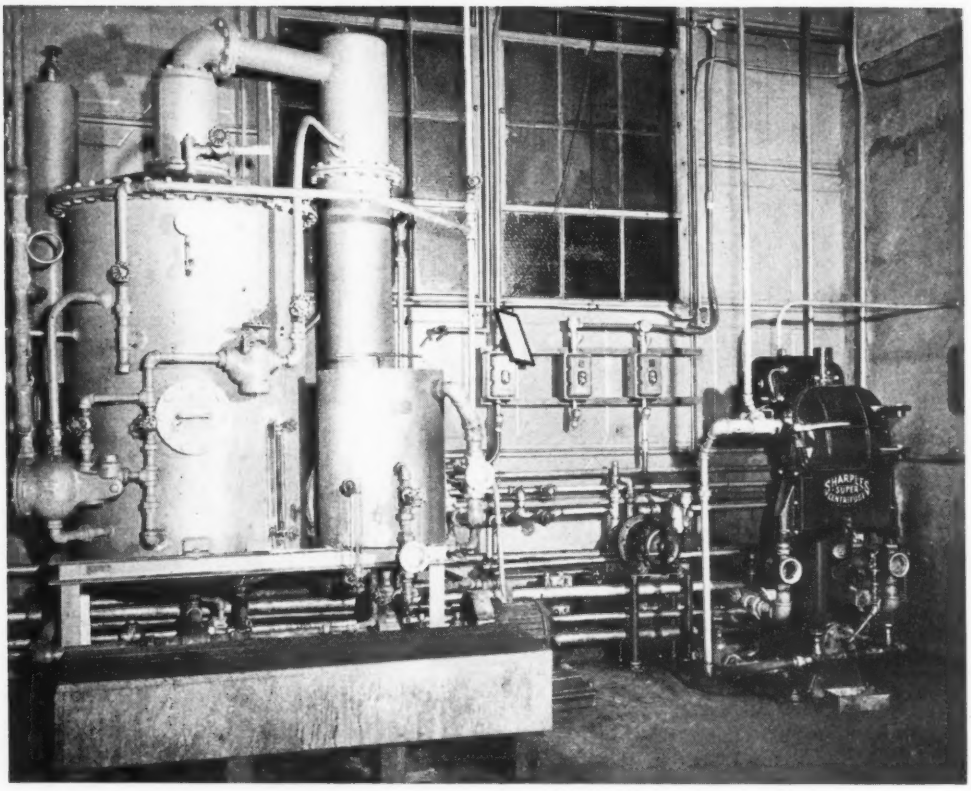


Fig. 1. Centrifuge and Simple Still Used for Reclaiming the Large Quantities of Stoddard Solvent Used in One of the Plants of the Wright Aeronautical Corporation for Washing Engine Parts

rosion inhibitor, so that when parts are immersed in it to remove excess cutting oil, a thin protective film will remain after the solvent evaporates.

As the solvent in the open tanks becomes very dirty, the tanks must be emptied and refilled at frequent intervals. Special portable tanks have been designed to facilitate the emptying and refilling. These portable tanks are divided into two compartments, each holding 550 gallons of solvent, and are equipped with suction and delivery pumps. They are carried through the shops on standard power-driven lift trucks, and at proper intervals are taken to the various open tanks for changing the solvent.

The "dirty solvent" is delivered into one side of the tanks, and clean blended solvent is pumped from the opposite compartment into the open tank. Similar portable tanks deliver straight solvent to the various spray booths. In one plant alone, more than 300,000 gallons of solvent are collected per month, of which more than 250,000 gallons are reclaimed and put back into circulation again.

The Stoddard solvent reclaiming installation in one plant is shown in Fig. 1. It consists of a continuous centrifuge through which the dirty solvent is pumped from an underground storage tank, and a simple, steam-heated still and condenser. Solids are removed by the centrifuge, and the solvent is then pumped into the body of the still, where it is heated to about 325 degrees F. The vapors are passed through a condensing coil and the clean condensate is discharged into a main storage tank. The non-volatiles, consisting chiefly of fairly heavy oils, are discharged into a storage tank; when a sufficient quantity has accumulated, this material is pumped to the main fuel-oil tanks to be used as fuel under the boilers. Any water that may be present passes off before the solvent, and is discharged into the sewers. The unit shown has a charging capacity of 300 gallons per hour.

In the reclamation process, it is extremely im-

portant to exercise strict supervision, so as to avoid contamination of the solvent by the admixture of gasoline. If this occurs in even a small percentage, the solvent loses its "safety" characteristics and becomes a fire hazard through the reduction of its flash point.

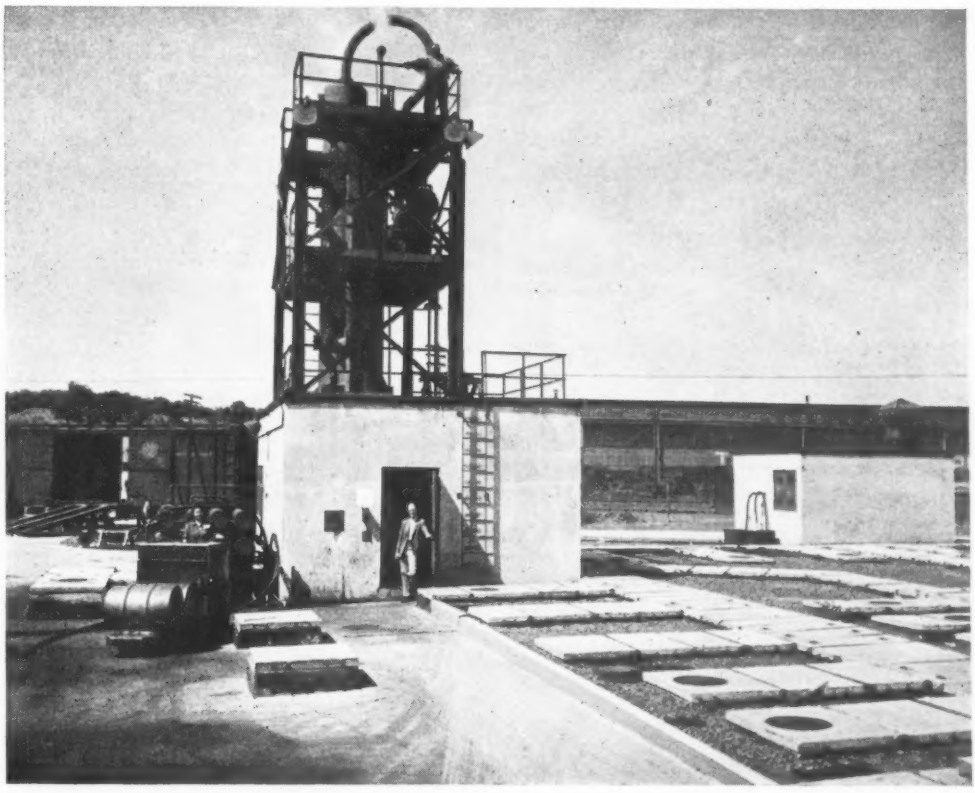
In one of the newer plants, this hazard has been eliminated through the installation of the fractionating tower shown in Fig. 2. With this system, the dirty solvent, as well as any "stray" gasoline, is collected in a 20,000-gallon tank, from which it is pumped directly to the fractionating unit. The gasoline is distilled and stored in a 5000-gallon tank for disposal. The clean solvent passes to the main solvent storage, and the residual sludge, consisting chiefly of oil, is dumped automatically into a storage tank, from which it is fed to the main bunkers to serve as fuel.

This method effectively solves the problem of gasoline disposal, of which there is inevitably a substantial quantity to be considered. Samples are taken at frequent intervals for laboratory control, and since these cannot be discharged into sewers, their disposal introduces something of a problem. Similarly, there is considerable drainage from fuel lines during the removal of an engine from the test stands and during the testing and calibrating of carburetors.

At the plants not served by the fractionating tower, the reclaimed solvent is checked as it leaves the still, and if the flash point is found to be lower than called for in the specification, the entire batch is run into drums. These drums are forwarded to the fractionating plant, and the contents stored in a tank until sufficient quantity has accumulated to provide a continuous two or three days' run. The batch is then discharged into clean drums and returned to the plant of origin.

The equipment shown in Fig. 3 is a cutting-oil reclaimer of the type used in the Wright plants. Each unit has a capacity of 300 gallons per hour, the combined capacity of the two units

Fig. 2. Fractionating Tower for Reclaiming Stoddard Solvent that has become Contaminated with Gasoline. The Concrete Slabs Give Access to Storage Tanks and Pipe Lines



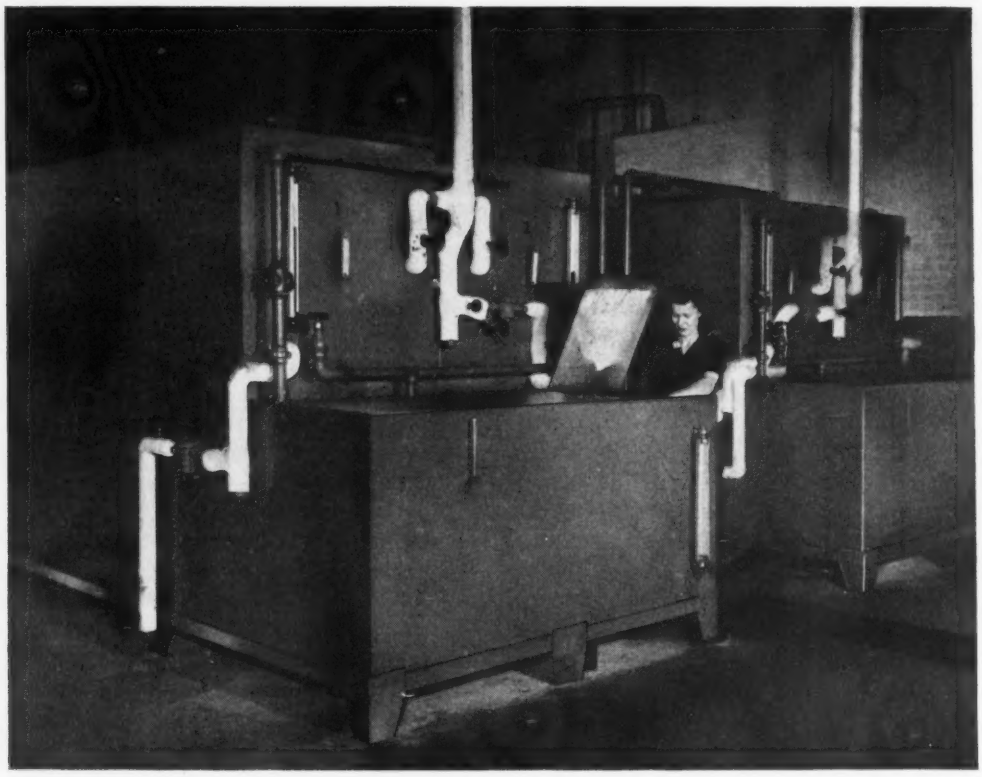
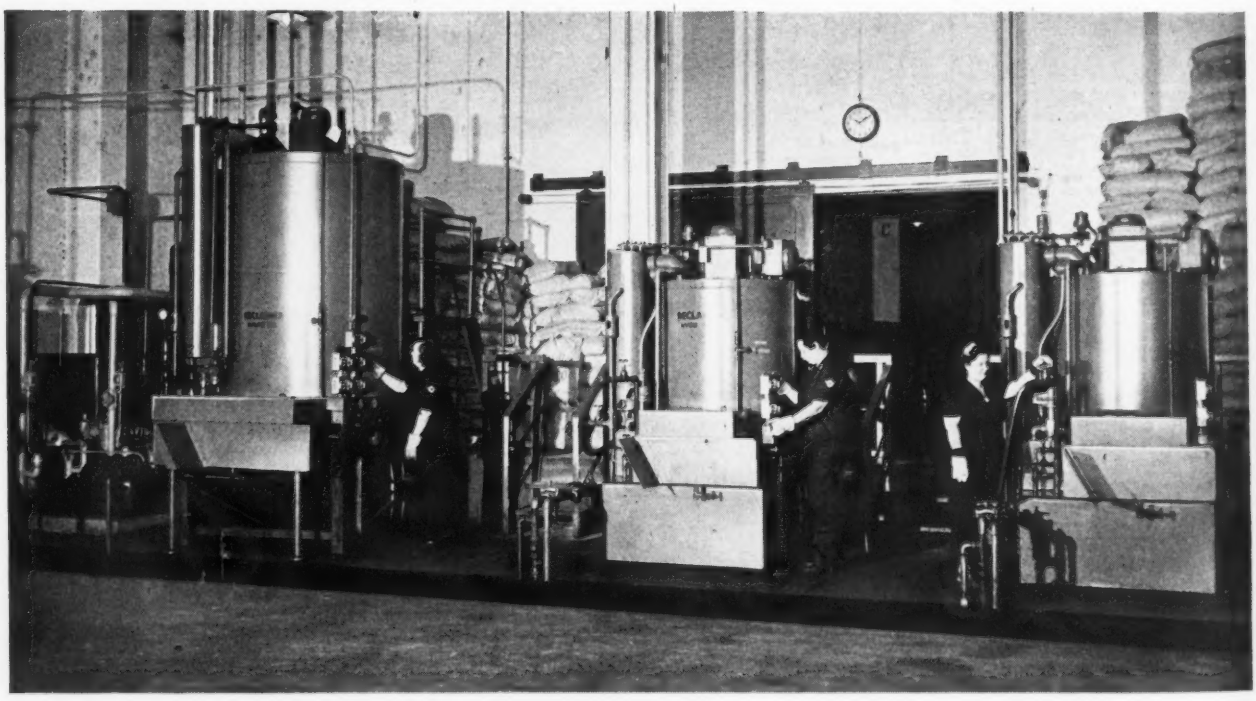


Fig. 3. (Above) Equipment in One of the Wright Aero Plants for Reclaiming Cutting Oils. Each of the Two Units has a Capacity of 300 Gallons per Hour

Fig. 4. (Below) Units Used for Reclaiming Engine, Hydraulic, and Lubricating Oils in One of the Plants of the Wright Aeronautical Corporation



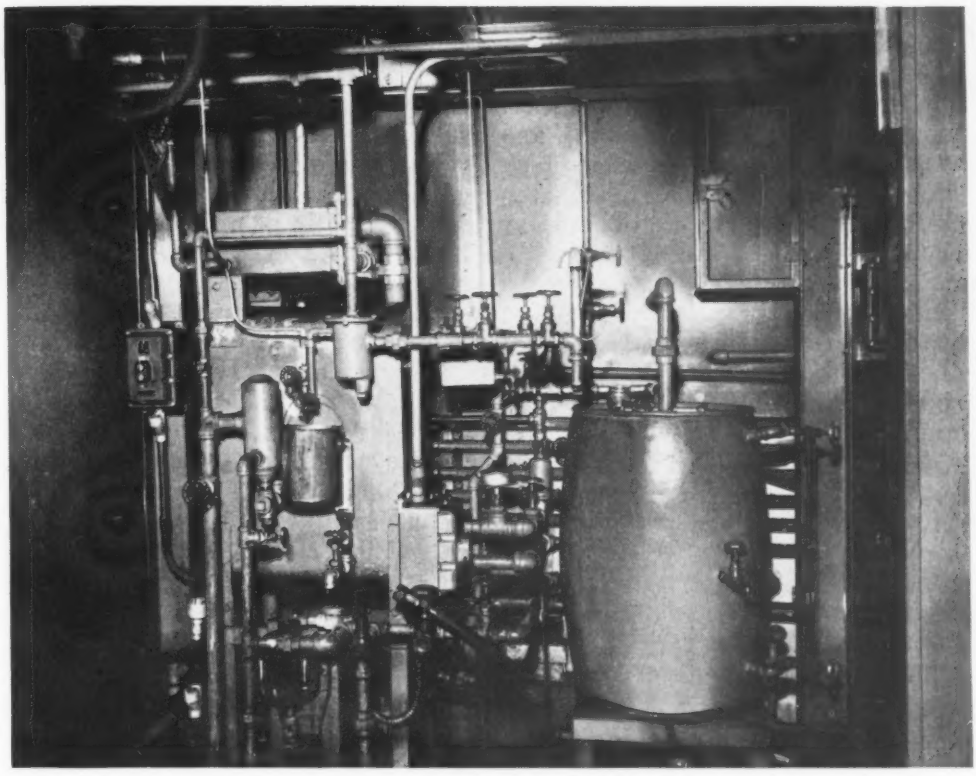


Fig. 5. Simple Distilling Unit for the Reclamation of Trichlorethylene Employed in Vapor Degreasers for Cleaning Operations

being sufficient to handle the daily requirements of a particular plant. By means of a centrifuge, the used oil is removed from the chips collected from machine tools, and is then piped into the upper compartment of the reclaimer. Here it is heated to 220 degrees F. for approximately one hour. This pasteurizes the oil, and permits the heavy particles of foreign matter to settle to the bottom of the tank.

The oil is then run off into the lower compartment, in which is a series of cloth filter bags, connected in parallel. The oil passes from the outside to the inside of the bags, and then into a third compartment in which it is again allowed to settle and cool before being drawn off.

Each batch of 600 gallons is checked for viscosity and sulphur content, and, if necessary, additional sulphurized base oil is added to bring it up to specification. Since this oil is necessarily a blend of the several oils used in the shop, the reclaimed product is given a special designation and is used for general machining purposes where highly specialized coolants are not required. Oil that is removed from machines under repair, or that must be changed due to a change in material being worked on, is trucked to the chip house and dumped into the centrifuge pits.

Lubricating oil forms an extremely important item for reclamation, and in the Wright plants is divided into three main groups. The first of these is engine oil, which has been used during the test runs on aircraft engines and which must be restored to comply exactly with the original specifications for new oil. The second group consists of the high-grade hydraulic oils used in the hydraulic operation of automatic machine tools, and the third is the circulating lubricating oil used in the headstocks, gear-boxes, and other machine tool units.

At the conclusion of each test run, the oil is drained from the aircraft engines and is collected in a 5000-gallon storage tank, from which it is pumped to the reclaimer shown at the left in Fig. 4. This equipment has a capacity of 175 gallons an hour. The oil is delivered into a tank, where it is mixed with fuller's earth, and then passed through a still operated at a temperature of 430 degrees F. All light constituents are thus

removed and are fed to the bunkers for burning under the boilers. The oil is raised by vacuum into the upper section of the reclaimer, from which it is forced through a pressure type filter. The fuller's earth is held by the filter cloths, and builds up into a highly efficient filter cake, which removes all dirt and foreign matter. Each batch of oil is sampled and checked by the laboratory before delivery to the main oil storage tank.

Hydraulic and lubricating oils are removed from the machine tools at regular intervals in accordance with a carefully prepared schedule, and are processed in the two units shown at the center and right in Fig. 4, in the same manner as the engine oil. These units have a capacity of 55 gallons an hour.

Vapor degreasers, which are used to a considerable extent for cleaning purposes, require some 3000 gallons of trichlorethylene a month. As this becomes too dirty for effective use, it is delivered to the still shown in Fig. 5, together with the oily sludge from the bottom of the tanks. The solvent is distilled off and run into drums for re-use, while the sludge is burned under the boilers. Each batch is checked for proper stabilizer content, and replenished if found deficient. This, however, is seldom necessary, since the distillation is carried definitely to the end point, the stabilizer being the last portion of the solvent to be distilled.

Equipment of the nature described is not cheap, that mentioned in this article costing over $200,000, but it is estimated that during the first year of operation, a direct saving of between $700,000 and $1,000,000 will be effected through its use in this plant.

A Platform for America

A RECENT statement by Eric Johnston, president of the United States Chamber of Commerce, outlines a number of principles that may well be combined into "a platform for America." This platform would read as follows:

We must continue to have faith in the courage, initiative, creative genius, and self-reliance of the American people, and must choose men for governmental offices who have this faith.

We must believe that our private enterprise system offers men and women more freedom and opportunity than any other system.

We must be willing to give every American an even break and a chance to take a chance.

We must insist that the rules of the game under which we work and live be fixed by law and not by autocratic officials.

We must recognize that the class struggle is the most insidious disease that can infect the national bloodstream.

We must insist that our officials spend other people's money as frugally as they would spend their own.

We must promote cooperation and unity by scrupulously treating all citizens and groups alike.

We must whittle down the excessive governmental power that is now concentrated in Washington and restore to Main St. the right to manage its own affairs.

We must elect men to public office who have the courage to speak out for a new job-making tax structure in place of our present self-defeating system.

We must select men who will encourage by word and action the creation of steady, well paying jobs in private industry, so as to lessen the need for public spending.

We must recognize that the highest standard of living for our people can come only from the production of more things to divide.

We must strive to recapture the daring spirit of adventure that made our country great.

Finally, we must boldly proclaim to the world America's intention to assume its full share of responsibility in the family of nations for the attainment of international security and peace.

* * *

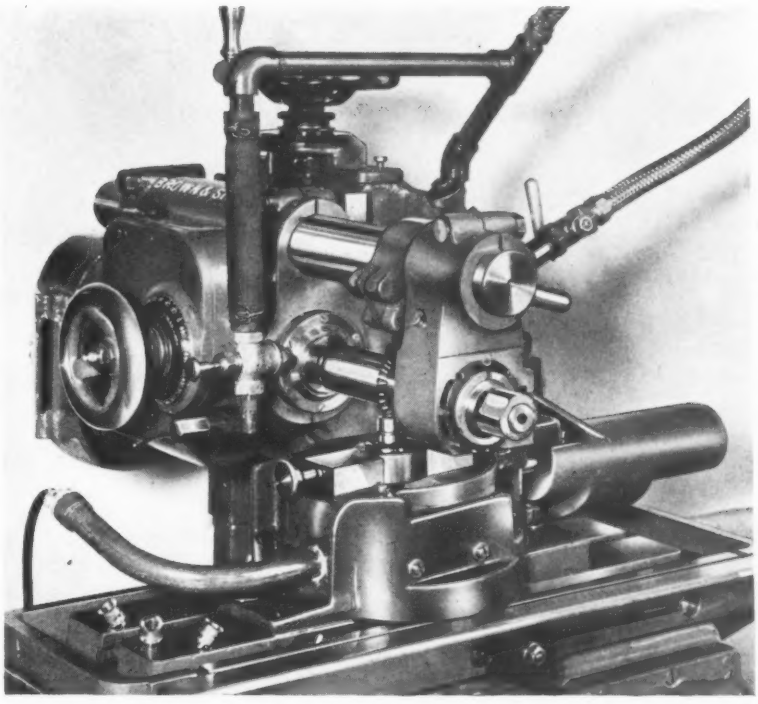
Post-war conditions are likely to be very difficult, both for employers and employes. They will be less dangerous if employes realize that the conditions which bring better profits bring better wages, and that adequate financial reserves are essential to company progress and to sustained employment; and if employers realize that industrial cooperation is capable of producing many valuable results.—*Stevenson, Jordan & Harrison, Inc.*

Increasing Production with Automatic Indexing Fixtures

Three Types of Automatic Indexing Fixtures – Mechanically, Electrically, and Pneumatically Operated – which Enable Accurate Work to be Performed at High Speed

IN order to utilize the full productive capacity of its Nos. 000 and 12 plain milling machines, the Brown & Sharpe Mfg. Co. has developed several types of automatic indexing fixtures for work requiring indexing from cut to cut. These fixtures are designed and built especially for each type of work in order to gain the greatest possible advantage by rugged holding, accurate rapid indexing, and ideal cutting conditions. Three types of mechanism have been utilized—one entirely mechanical, operated by the machine itself; another operated electrically; and a third actuated by compressed air, electrically controlled.

The mechanically operated fixture is of relatively simple design, deriving the power for the indexing mechanism from the table travel of the machine. As the table returns in "power fast travel" after completing the cutting action, a ratchet arrangement automatically brings the work-spindle into approximately the correct position for the succeeding cut. Upon the forward travel of the table as the work advances to the next cut, a spring-cushioned plunger in a cylinder at one side of the fixture engages a spring-controlled index-plunger in the fixture, forcing the latter to enter a notched index-plate in the fixture base. This locates the work exactly in relation to the cutter, and locks the work in position throughout the cutting



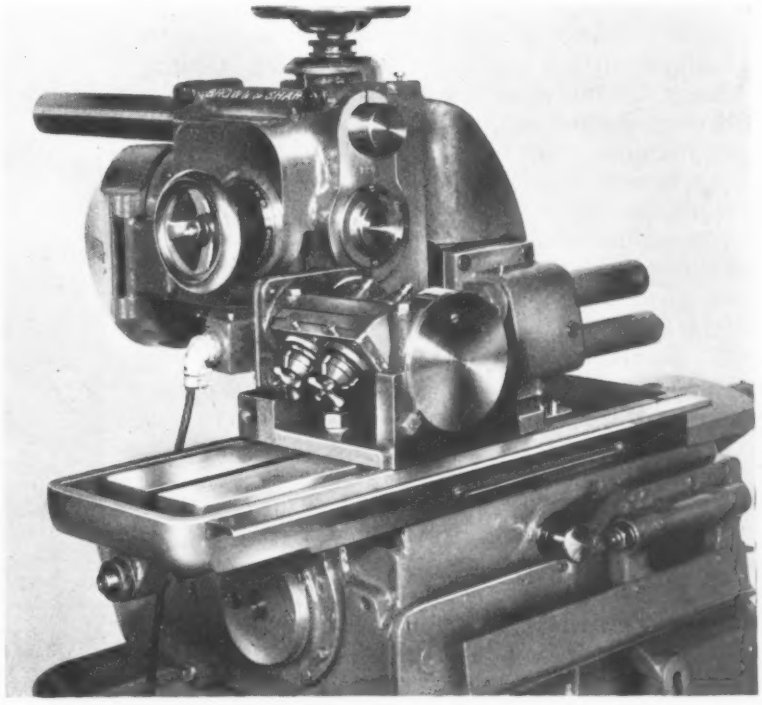


Fig. 1. (Above) Cutting Clutch Teeth in a Mechanically Operated Indexing Fixture. Fig. 2. (Below) Cutting Short-faced Bevel Gears in Two-spindle Indexing Fixture

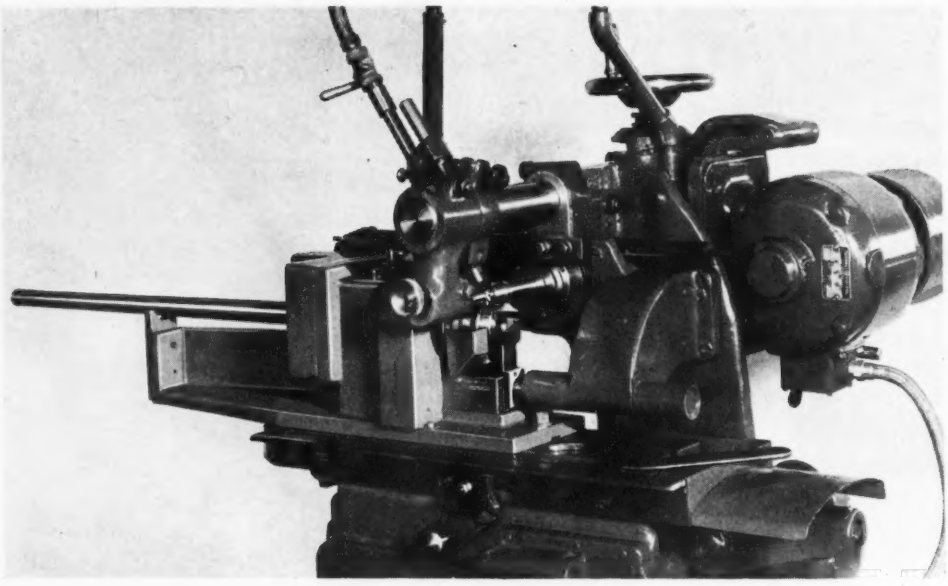


Fig. 3. Set-up for Cutting Two Notches in a Machine-gun Barrel at Each Indexing

action. The plunger recedes into the cylinder to the extent required for the length of cut on the work.

After the work is loaded in the fixture, the operator starts the automatic cycle of the machine by pressing the starting button, and the machine continues through the required number of milling cycles until the work is completed, at which time it stops, with the table at the loading position. The stopping position is controlled by a micro-switch, tripped by a button mounted on the index-head spindle in a location adjacent to the final cutting position. This type of indexing fixture is suitable for work that is indexed through a small arc, and can be utilized for work requiring a spindle in vertical relation to the table travel or a spindle either parallel or crosswise with the table travel.

The illustrations Figs. 1 to 5 show the general construction of this type of mechanism. Fig. 1 shows a No. 000 plain milling machine cutting clutch teeth in a telegraphic typewriter part. The part is held on a split stud, the spindle of the indexing fixture being clamped by a spring plunger (shown at the left of the fixture) while the expanding screw is being tightened.

The fact that the clutch is made of very tough die steel requiring a slow feed rate, combined with an extremely short face, would present a problem of wasted cutting time if it were not possible to set the machine for a short cut. Including clearances and run-in, the length of the cut is only 1/2 inch. One clutch tooth is completed each nineteen seconds. A table cam providing 4 1/2 inches total travel of the table is used in order to reduce the "rapid travel" time to one second per cut.

The double-spindle fixture illustrated in Fig. 2 is used for cutting short-faced bevel gears for counting mechanisms. The fixture is adjustable to the required cutting angles by means of graduations. The gears to be cut are made from brass, permitting a high feeding rate. Accordingly, the machine is arranged with a 3-to-1 feed

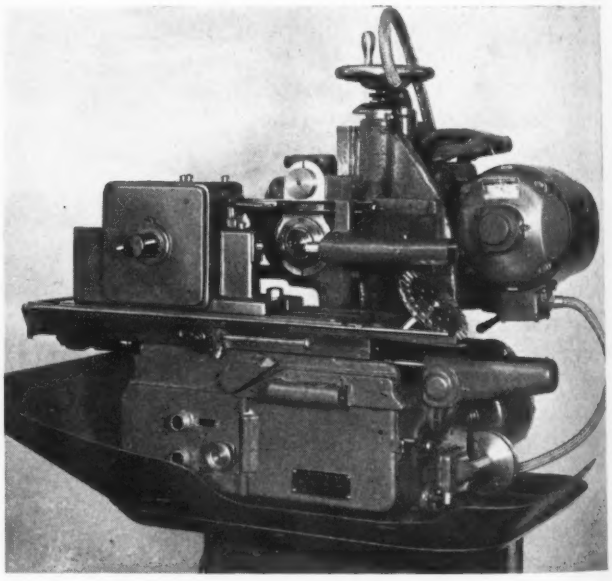


Fig. 4. Milling Relief Grooves in Brass Pump Impellers

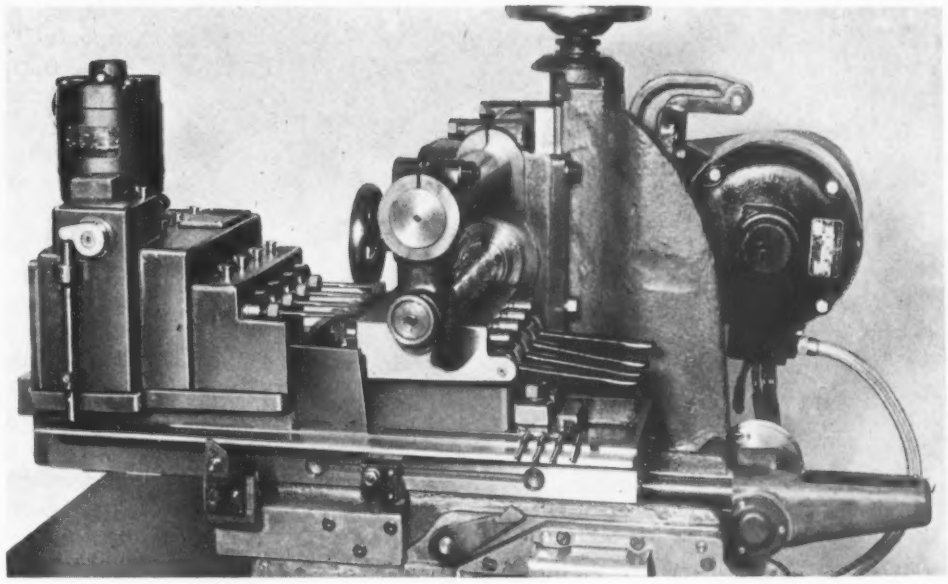


Fig. 6. Fluting Small Taps, Four at a Time, in Electrically Operated Indexing Fixture

ratio, providing a range of feeds from 1 11/16 to 73 1/4 inches per minute. This feed range, together with a 4 1/2-inch table cam, makes possible a 1 3/4-second table cycle, thus producing one gear tooth every 7/8 second. The gear blanks are held on split studs and clamped by knobs at the rear of the spindles.

Fig. 3 shows a set-up for cutting two notches at each indexing in a machine-gun barrel, thus reducing the number of indexings required by half. The barrel is inserted through the hollow spindle of the fixture, and is clamped by a collet arrangement.

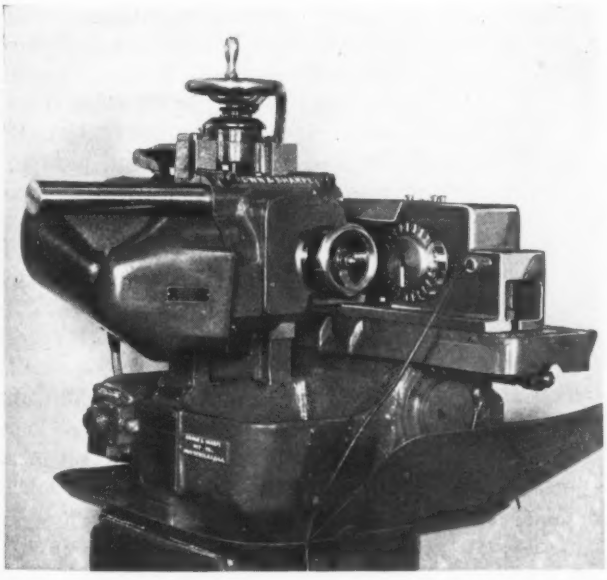


Fig. 5. Rear View of Indexing Fixture Shown in Fig. 4

Figs. 4 and 5 show the operation of milling the relief grooves in brass pump impellers for an aircraft engine. The work is done on a No. 000 plain milling machine equipped with a 4 1/2-inch table cam. The cutting time per slot is two seconds, which, with the rapid travel time of one second, represents a table cycle of three seconds.

The second type of fixture, used for work requiring indexing through a large arc, such as for a low number of divisions, utilizes a torque motor as an auxiliary source of power. During the cutting portion of the milling cycle, the torque motor holds the ratchet type index-plate against the index locking pin, thus holding the mechanism in position. When the table returns after completing the cut, a dog mounted in the T-slot on the front face of the table momentarily withdraws the locking pin, permitting the motor to rotate the index ratchet, which, in turn, is repositioned by the reseating of the locking pin. In multiple-spindle arrangements, the backlash is eliminated by mounting the index-plate and locking pin on the outside spindle farthest from the torque motor. The table stops in the loading position after the last cut has been taken. Figs. 6 and 7 show adaptations of this type of index-head.

Fig. 6 indicates the fluting of small taps, four at a time. The base of the fixture is machined on a slight angle to produce the taper of the tap

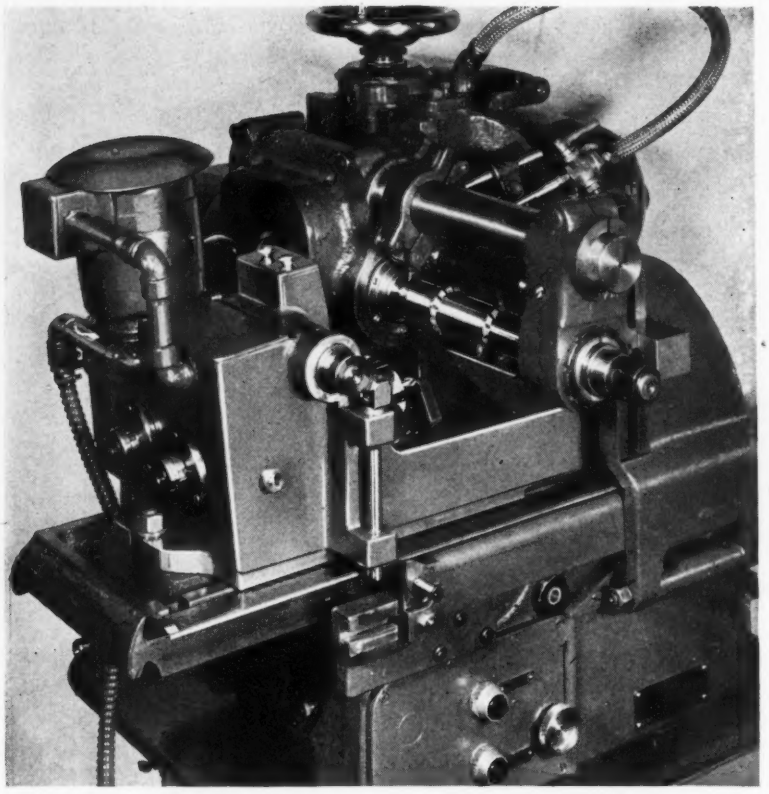


Fig. 7. Milling Four Grooves in a Special Type Screwdriver, Using Electrically Operated Automatic Indexing

grooves. The multiple work-spindles have square female centers into which the squared tap shanks fit and are held for indexing. The right-hand ends of the taps are supported in round female centers clamped by cam-operated levers. Index-plates are provided for milling two, three, and four flutes.

In Fig. 7, four grooves are milled in a special type screwdriver. These screwdrivers, of varying lengths, are inserted through the rear of the fixture spindle. The parts are held in holders somewhat similar to screw machine feeding fingers, and are pushed against the fixture stop while the collet chuck is being tightened. An extra set of holders permits the operator to load two holders while the machine is cutting the blanks held in position in the other set.

The third type of indexing fixture utilizes a solenoid-controlled pneumatic system for its motive power. The fixture is operated by a double-action air cylinder, which, in turn, rotates a ratchet index-plate through power applied by a rack and segment. During the cutting action, the ratchet type index-plate is kept in contact with the index locking pin by the pressure of the air in one side of the air cylinder.

After the completion of the cut and during the return of the table in fast travel, air is momentarily directed into the reverse side of the air cylinder, thus rotating the segment in the opposite direction and removing the pressure on the locking pin. A cam on the segment withdraws the locking pin to clear

Fig. 8. Roughing Bevel Gears for an Aircraft Mechanism, Using Solenoid-controlled Pneumatic Indexing

the top of the index-plate tooth, and, with the return of the original direction of the air pressure, the pin drops into engagement with the next tooth in the ratchet index-plate, completing one indexing. The supply of air to the cylinder is by means of a valve operated by a solenoid, which, in turn, is controlled by a limit switch on front of the table.

The table travels only enough to take the required length of cut and to have the cutter just clear the work upon the return of the table. This travel is controlled by the usual setting of the table control dogs. At the completion of the last cut, the table returns past the usual point of reversal to the extreme of its travel, to give ample room to reload the work in the fixture. This is accomplished by an electrical tie-in with the standard electrical controls governing the functions of the automatic table cycle, and is engaged by a micro-switch with button control on the index-head spindle, adjacent to the final cutting position of the index ratchet.

An example of work done on this type of fixture is illustrated in Fig. 8. The operation shown is the roughing of bevel gears for retractable landing mechanisms for aircraft. The cut is taken by climb-milling, and the rugged nature of the fixture and machine permits a high rate of production. In the illustration, the guard over the solenoid control and also the outer braces are removed to show the fixture construction clearly.

An advantage of all three types of indexing fixtures is the extreme rapidity with which the indexing is accomplished during the period the table is returning in rapid travel. There is no dwell required while the work is being indexed. In addition, the positive lock keeps the work accurately positioned throughout the cut, while the rigidity of the fixture permits the full cutting capacity of the machine to be utilized.

Saving Maintenance Costs by Proper Lubrication

MUCH has been written on the subject of reducing costs and increasing production through the employment of efficient machines and methods. Today, one of the most important phases of this subject is the maintenance of machines; for it is only through proper maintenance that it is possible to attain the production expected from them. A twofold saving is obtained by reducing the time and labor required for their maintenance. One of the most important factors in the maintenance of any machine is proper lubrication. The best machinery and tools will operate unsatisfactorily if not properly lubricated; and, expensive equipment can be quickly ruined by faulty lubrication.

Proper lubrication involves not only the use of a sufficient amount of lubricant, but also the employment of the right kind of lubricant. All types of machine equipment cannot be best served by the same type of lubricating oil. Knowledge of how to apply the right lubricant in the right place is a valuable asset in any plant. To secure efficient lubrication of bearings, gears, and other moving parts in machinery, several factors must be coordinated.

Seldom, if ever, are equipment installations identical in every respect. The design of a machine and the work it is doing may be the same, but the operating conditions may vary widely. Surrounding temperatures, speeds, load, and pressures are important factors in determining the operating conditions. These are but a few of the points that must be taken into consideration in applying lubricants.

The large manufacturing companies have wisely employed lubrication engineers who make it their full-time duty to ascertain the correct lubricant for each type of machine in their plant. However, smaller plants can obtain equally expert advice from their suppliers of petroleum products, who have a staff of consulting engineers available to aid in the application of their products for the greatest efficiency.

To aid industrial plants in achieving proper lubrication, and to impress upon the men responsible for maintenance the importance of applying the right lubricant in the right place, one of the oil companies—the Sun Oil Co., Philadelphia, Pa.—has inaugurated an educational plan entitled "Save and Serve with Proper Lu-

brication." This plan is available without cost to every industrial plant. It includes a lubrication manual, which describes the basic principles of industrial lubrication; a wall chart for maintenance men and operators; and plant posters to drive home the importance of lubrication to employes. The company has also published industry folders giving actual case histories of the savings attained by the application of proper lubricants, and technical bulletins giving engineering information on the application of lubricants to different types of industrial machinery.

Proper lubrication may seem somewhat intangible to many, but the savings that can be obtained through a study of proper lubrication are amply illustrated by a number of examples recorded in various industrial plants.

One outstanding example is that of a large Pittsburgh steel mill. At one time, there was an average of one bearing failure a day due to faulty lubrication. By selecting the proper lubricant and applying it correctly, the bearings are now being preserved, and a saving of $1400 was recorded in the first six months. In addition, the power consumption dropped 40 per cent, and the lubrication costs 27 per cent.

In another case, a large tool and die manufacturer was constantly troubled with sticky, sluggish operation of the table ways on milling machines. Accuracy was almost an impossibility where limits had to be held to 0.0001 inch. A careful study of the lubricant used on the table ways resulted in changing the type of lubricant, and since then, there has been no trouble. Here is a case where the savings in the reduction of rejections through proper lubrication have amounted to thousands of dollars annually.

In still another instance, the bearings on large forming presses in a Detroit plant failed constantly due to unsatisfactory lubrication. This meant shutting down for bearing replacements and the holding up of production. When the proper pressure grease was applied, these difficulties were eliminated and the consumption of grease was cut in half. The maintenance costs were considerably reduced, and production on the presses was greatly increased.

A New England arms plant had a lubrication problem in connection with the drawing of 105-millimeter cartridge cases on toggle type presses. The oil that leaked out had a high sulphur content and contaminated the drawing emulsion used for the cartridge-case operation. This discolored and stained the cases, requiring an additional cleaning operation. Selecting a lubricating oil with a low sulphur content eliminated this difficulty. In addition, the oil consumption was reduced by at least one-third.

These are but a few examples of the value of correct maintenance and proper lubrication. They show what has been accomplished by a study of lubrication problems and by changing, when necessary, to a more suitable lubricant. Today, with equipment being driven at a "break-neck" pace, it is no exaggeration to say that the selection of the right kind of grease or oil is just as essential as the selection of the right kind of machine and tool.

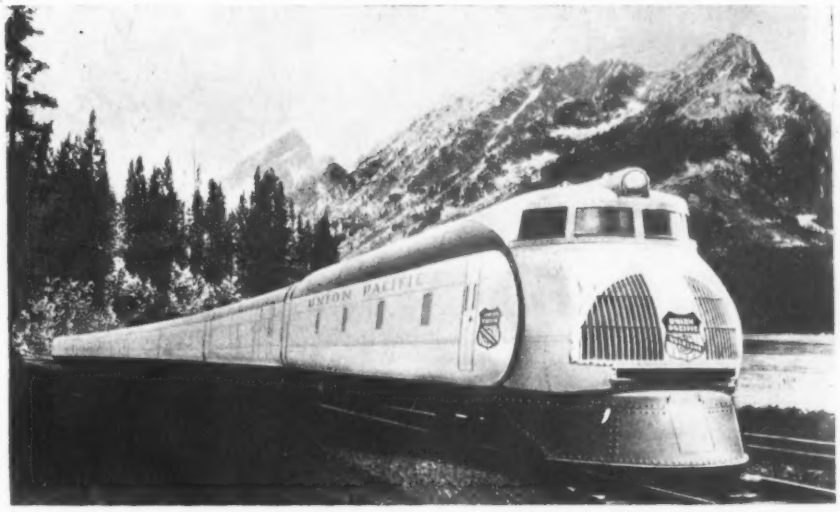
Large Carbide Parts Formed by Hot-Pressing

THE production of cemented-carbide parts too large to be sintered in available furnaces, as well as special, thin-walled parts that tend to become out-of-round when pressed and then sintered in the regular way, has been made possible at the plant of the Carboloy Company, Inc., Detroit, Mich., by the development of a "hot-press" method which incorporates in a single operation the three distinct processes of pressing, semi-sintering, and sintering. The hot-pressing method of producing large carbide parts—in some of which the carbide alone weighs up to 100 pounds—has proved highly successful. It is believed that after the war, carbide forming dies for the deep-drawing of kitchenware, head-lamp shells, etc., can be made economically by this method.

The procedure, which employs electrical resistance heating to obtain the necessary sintering temperature, makes use of a hydraulic press exerting a 100-ton forming pressure. This press is equipped with water-cooled platens and is similar to a "press welder." Heat is supplied through a 750-K.V.A. transformer and is controlled by General Electric electronic contactors. The press, now in regular operation at the Carboloy plant, handles jobs up to 100 square inches in cross-section. The maximum height of work that can be handled is 8 inches. The molds used are of a graphite-base composition.

Light-Weight Metals in Post-War Industry

By JAY M. SHARP
Aluminum Co. of America



PEERING into the world of tomorrow, a famous scientist recently said: "Things that move will be made out of aluminum and magnesium; things that stay put, out of iron or steel." Those of us who are engaged in the light metals industries would doubtless be glad to accept such an arrangement; but it is obvious that a clear-cut line of demarcation of this kind would be impractical. The light metals will not and cannot form the structure of "everything that moves," nor could the things that "stay put" be produced entirely without such metals as aluminum, magnesium, and beryllium.

The fact remains, however, that the light-weight metals will find their chief application in the field of transportation, where "things move." A survey made in November, 1939, revealed that 29 per cent of the aluminum produced in this country was used by companies engaged in land, air, and water transportation. Recently, it has been estimated that approximately 90 per cent of the current all-time high production of aluminum (the current production capacity is approximately 2,100,000,000 pounds per year) is being utilized by the aviation industry—an understandable percentage when one stops to realize that about 75 per cent of the weight of a modern plane is made up of aluminum.

No one would say that all of this tremendous production will go into airplanes after the war. However, it is fairly safe to conclude that the aviation industry, though not as large as today, will be considerably larger than before the war. Thousands of young men, and women too, will have been trained to fly planes, and many of them will no longer be satisfied with other and slower means of transportation. Furthermore, some aviation experts predict that the helicopter will develop an entirely new plane market after the war, and will rival the "flivver" of another era. Lighter-than-air craft will also come into its own after the war, according to many predictions, and here again the light weight of aluminum will dictate its application.

Aluminum in the Automobile Field

The automobile field offers a distinct opportunity. Prior to the war, aluminum had proved its worth under actual service conditions in the production of cylinder heads, cylinder blocks, oil pans, cylinders, pistons, and connecting-rods.

However, aluminum engineers maintain that it should be possible to reduce the over-all weight of the standard 1942 car by 30 per cent through a more liberal use of this light-weight metal. Half of this weight reduction could be obtained by using aluminum, and the other half by more economical design of the ferrous metal parts.

The use of aluminum in trucking equipment was firmly established before the war, although engineers will find an even greater number of applications when the metal is again released for civilian use. Operators realize that for every pound of dead weight saved, a pound of payload can generally be added.

The all-aluminum bus will return, too. The War Production Board has already released limited amounts of aluminum for the manufacture of busses. It is interesting to note the following statement issued by the Board at the time the restrictions were eased on the use of aluminum for busses: "Aluminum busses present many advantages over their heavier counterparts. There will be some additional passenger space, the lighter weight will make for a saving in gas consumption, and, most important, ease excessive pressure on tires, thus permitting a more successful use of synthetic rubber for bus tires."

Applications in Railroad Transportation

Railroad equipment presents another important market for aluminum after the war. The first all-aluminum streamline train made its debut in February, 1934. Since that time about a dozen all-aluminum trains, as well as a number of individual passenger cars, have been built and are now in service. Their performance has been highly satisfactory, and they will probably be followed by many more aluminum trains.

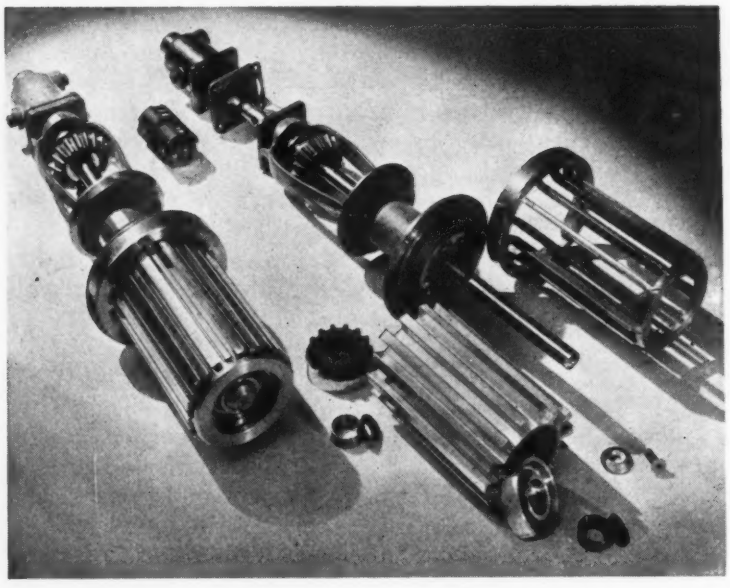
In addition, tests have shown that aluminum is particularly adaptable to the construction of hopper cars and tank cars. Sulphur, for example, attacks steel rather rapidly, but has no appreciable effect on aluminum. All coal contains some sulphur, and this has always been a problem to railroads. Aluminum hopper cars will therefore be most useful in the post-war era.

Aluminum tank cars have been in successful operation for more than fifteen years. Because there is no rust to destroy the tanks or contaminate the contents, and no necessity for expensive linings that may require replacement, aluminum tank cars are used for transporting hydrogen peroxide, acetic acid, nitric acid, formaldehyde, and other chemicals.

Use of Aluminum in Shipbuilding

In the field of marine transportation there are many interesting developments. Aluminum lifeboats have proved to be free from major maintenance problems, and also serve to lessen the weight of the ship at a point where weight is least desirable, namely near the upper decks.

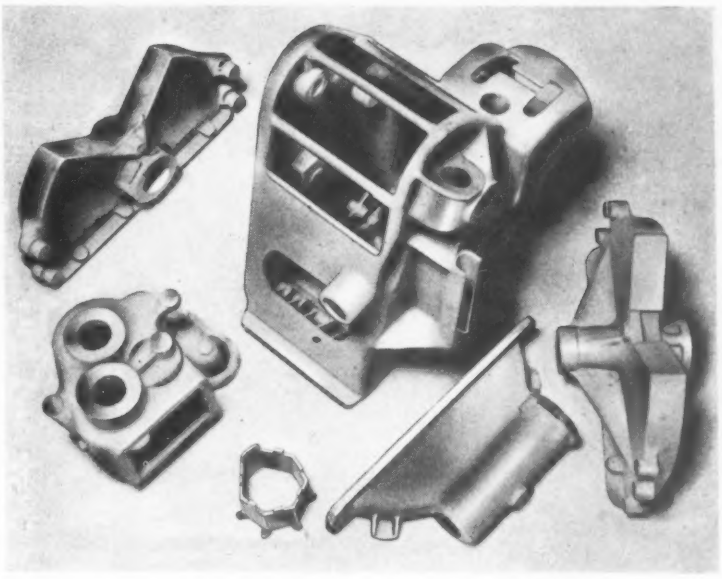
Extensive studies are now being made regarding the advantages of aluminum for the entire superstructure of passenger ships. This type of construction, which has distinct post-war possi-



Assembled and Disassembled Drying Reel for Removing Excess Moisture from Rayon Yarn. Aluminum is Used in Making this Reel because of Its High Heat Conductivity, Resistance to Corrosion, and Light Weight for Rotating Parts

bilities, would result in a major reduction in top weight, and would do much toward eliminating the difficult stress conditions that exist under present methods of construction.

Aluminum, and magnesium too, because of their light weight, have been used for some time in high-speed reciprocating machinery and equipment. The textile industry, for example, offers an attractive field for the use of aluminum because of its light weight and resistance to chemical attack. The forged aluminum spinning bucket, which spins at high speeds, is a good example of this type of application.



Examples of a Number of Magnesium Aircraft Sand Castings

Aluminum in the Electrical Field

Here are a few examples of ways in which aluminum will be used in the production of things that "stay put." By virtue of its high electrical conductivity and light weight, aluminum has found wide acceptance in the electrical industry in the form of conductor cable, industrial bus-bars, conduits, housings, windings, and other uses. More than a million miles of high-voltage aluminum conductor cable, steel reinforced (known as A.C.S.R. in the trade), now spans our country.

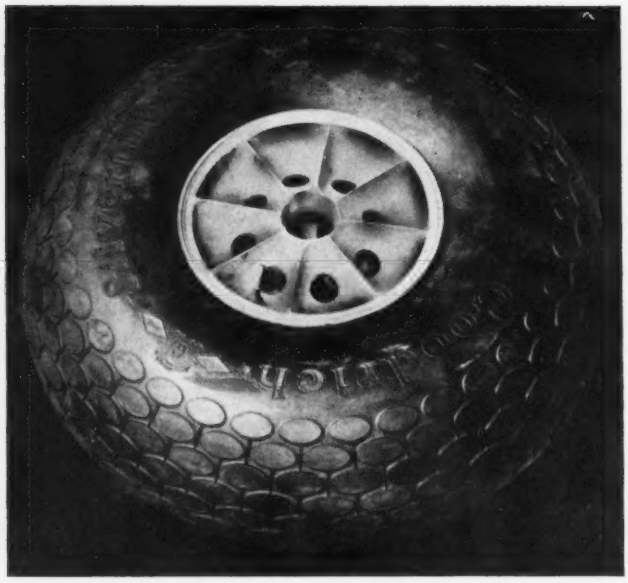
Practically pure aluminum has an electrical conductivity equal to 61 per cent of the International Annealed Copper Standard (volume basis). However, because of its light weight, it has a mass conductivity of more than 212 per cent that of copper. It is therefore possible that lower cost aluminum will make the metal available for all manner of insulated cable and wire, both for industrial and domestic use. For example, the Technical Advisory Committee for Aircraft Cables, composed of representatives of cable manufacturers, aircraft manufacturers, and the Army and Navy, is investigating the advantages of using aluminum cable in the distribution circuits of large aircraft. The present conductors, which exceed in size those formerly used, now weigh well over a pound per foot in some cases. Aluminum cable of the same conduction weighs approximately half as much. Experimental lots of this cable have been made up by a number of wire manufacturers, and at least one aircraft company is now using flat aluminum bus conductors in the distribution system of planes.

Increased Application of Aluminum Sheets

Engineers and designers will do well to note the present all-time low price of aluminum sheet, for this will doubtless lead to a general widening of the scope of usefulness of this material. It will compete with other sheet metals for applications in heating and ventilating equipment and in air-conditioning units. Furthermore, aluminum corrugated sheet will find many postwar uses for roofing and siding, on both industrial and farm buildings.

Another field for aluminum will be in the manufacture of household appliances. Improvements in the methods of assembling and finishing will combine with the lower cost of aluminum to recommend this metal for all manner of equipment, such as stoves, steam-electric irons, refrigerators, and various types of cabinets. One midwestern manufacturer is already producing an ice refrigerator made of aluminum, which weighs only 53 pounds, although it has a food capacity of 4 cubic feet and will hold up to 110 pounds of ice. The same company is making a combined kitchen range and sink that weighs only 45 pounds.

Manufacturers in general, and designers and engineers in particular, will be interested in what the Aluminum Co. of America has termed the "twelve economic advantages of aluminum": (1) High resistance to corrosion; (2) light weight; (3) high electrical conductivity; (4) high



Airplane Wheel Hub Made from Magnesium

conductivity for heat; (5) high reflectivity for light and radiant heat; (6) workability; (7) non-magnetic qualities; (8) non-toxic qualities; (9) strength in alloys; (10) non-sparking characteristic; (11) appearance; and (12) high scrap and re-use value.

The Prospects for Magnesium

Until very recently, magnesium has been popularly known in industry as the "mystery metal." The war emergency and the resultant necessity for greater magnesium production, as well as improvements in fabricating techniques, have done much to increase the knowledge of this metal, which is one-third lighter than aluminum. Contrary to popular opinion, magnesium is the easiest of all metals to machine, although proper precautions must be taken because of the combustible nature of the metal. Tool speeds are high, feeds are fast, cuts are deep. These factors—light weight and ease of machining—insure the metal a prominent post-war place.

Today, the greatest single use of magnesium is in incendiary bombs and other pyrotechnic devices, such as flares and tracer bullets. Such uses took considerably more than half of the country's output in 1943. Second in volume, but more important in peacetime, are structural uses. The average military plane today contains about 1000 pounds of magnesium; the largest nearly a ton. Most of this magnesium is in engine parts and wheels, although some airframes may include magnesium up to 2 per cent of the total weight of the frame.

Any prediction of the future of magnesium is bound to be guesswork at this time. However, it seems fairly certain that the metal will become an important factor in the construction of transportation equipment and in the moving parts of stationary equipment. Portable typewriters, hand-trucks, and household gadgets are possible peacetime applications of magnesium.

Plastics in Their Relation to Light-Weight Metals

No discussion of the possibilities of light-weight metals in post-war industry would be complete without some reference to plastics and their relation to these metals. Because of the great amount of publicity that has been given to the new field of plastics, light-weight metals producers are often asked if they are not afraid of competition from this direction. The question has at times carried the implication that the light metals must be planning to "fight" plastics.

Actually, many ways are being found in which plastics and other new materials may supplement and promote the use of the light metals. Among the plastics are materials which, in conjunction with the metals, will often do a better job than either material can do alone. For example, it has already been pointed out that aluminum is an excellent conductor of electricity. Plastics, on the other hand, are excellent insulators. Aluminum wire with plastic insulation therefore points to an interesting use of both products, and promises a wider market for both.

The situation is perhaps best summed up in an advertisement by the Aluminum Co. of America, which says in part: "Plastics do many things better than any other material; aluminum does many things better than any other material; the two can team up to do a better job in certain situations than either could do alone."

In this realistic fashion, aluminum and the other light-weight metals are facing their post-war future. What the exact nature of that future will be no one can say; but careful planning, intelligent use of expanded production facilities, and wise administration of employment problems resulting from the thousands of new workers who have learned how to work with these metals will make that future, regardless of its nature, a promising one.

Hydraulic Oils for Machine Tools

Evaluating the Properties of Hydraulic Oils and Methods of Testing Oils to Determine Their Relative Advantages

By VINCENT M. DROST
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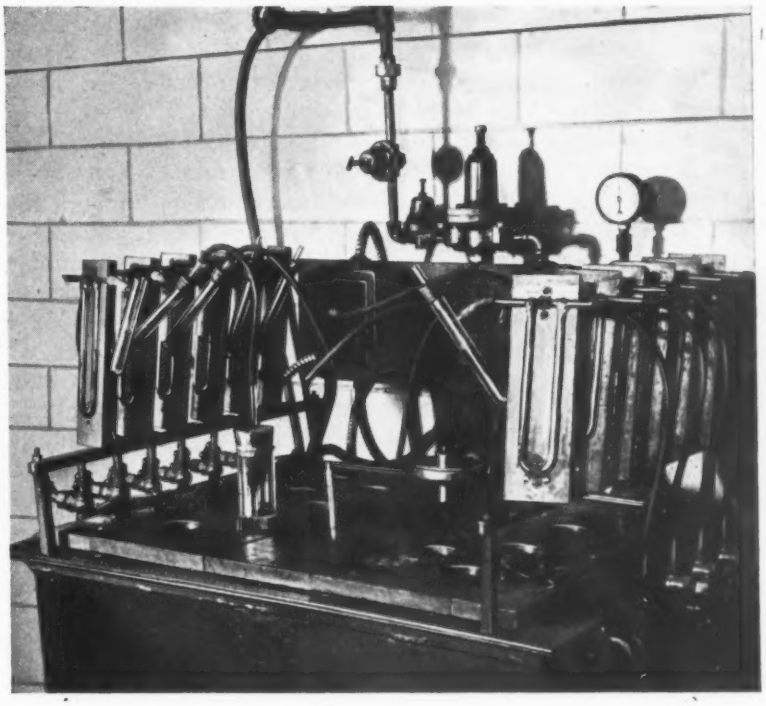


The Indiana Oxidation Machine which is Employed for Making the Continental Oxidation Test on Oils Used for the Hydraulic Operation of Machine Tools

NOW that hydraulic machines are here to stay and a large percentage of new equipment is being designed to include hydraulically operated mechanisms, the proper selection of oil is of great importance, and the intelligent use of a good oil is basic for efficient, uninterrupted operation. The general attitude of the lubrication engineer, especially in the automotive field, points the way to a better understanding of the problems confronting the man responsible for the selection of hydraulic operating oils.

The trend in the selection of lubricating oils by a practical service evaluation, instead of by a mere comparison of physical analyses, has been of great aid to automotive engineers in selecting those types of lubricants that will give the desired results in the field. Much has been written on the subject of evaluation of crankcase oils, based on experience provided by years of laboratory and field research. In every case, practical evaluations such as provided by the "Chevrolet Engine Test," the "G. M. Series 71 500-Hour Test," and the "Caterpillar Scratch Test" have demonstrated the fact that oils cannot be judged by the simple expedient of a brief review of physical specifications.

A request for specifications for a hydraulic oil invariably brings forth physical specifications of flash and fire points, viscosity at 100 and 210 degrees F., gravity, Conradson carbon, and acid number. True, some oil companies include demulsibility, and some interpret the given viscosities in viscosity index figures. While these specifications are of value in selecting a type of oil, it is a fact, as automotive engineers have found, that the service characteristics may vary widely.

Regarding with envy those automotive engineers who have at their disposal field evaluation tests, the lubrication or plant engineer, whose responsibility it is to select the proper hydraulic oil for machine tool operation, studies physical specifications while he listens to the oil engineers extolling certain "outstanding characteristics" of the oils manufactured by their respective companies.

Hydraulic Oils of Similar Specifications May Not Give the Same Operating Results

As an example, machine tool builders may specify a hydraulic oil as "a high-grade mineral oil" of a given viscosity at 100 degrees F., and, in some cases, with a minimum viscosity index. Oil "A," meeting such specifications, may function quite efficiently for a period of, say, 1000 hours without any trouble. Examination of the valves, ports, and other critical parts of the hydraulic system will reveal little or no gum accumulations. Operation of the machine will continue for extended periods and through many reservoir changes without any difficulty from gum formations.

On the other hand, oil "B," having similar "paper" specifications, and qualifying equally as to the requirement of the machine tool builder, may cause gum deposits resulting in erratic operation after only half the number of hours dur-

ing which the same machine operated satisfactorily on oil "A," under similar conditions. Oil "B" is, manifestly, of poor oxidation stability, which under the existing operating temperatures and pressures has broken down, with the inevitable formations of gums and resins. These gums and resins, once formed, are deposited at high velocity points where oil is being forced through small orifices at high pressure. These small orifices act as filter points, and, after gums have formed in the oil, they rapidly accumulate and collect. The problems presented are familiar to the lubrication department of any plant using hydraulic machines.

Every machine tool operator and maintenance man knows that when gums form in critical places in a hydraulic circuit, the action of the machine tool is seriously impaired. This is reflected in jerky feed, erratic valve action, poor indexing, table chatter, and poor finish.

Experimentation in actual machine tool operation with all marketed oils is, of course, impractical. A fair, comprehensive test of a hydraulic oil in a plant is a long drawn out and often expensive procedure. Hydraulic oils certainly cannot be truly evaluated in production departments in less than six months, and sometimes periods extending over a year or more are necessary.

A simpler, quicker method of measure was looked for and many different methods were investigated. Engine tests were discarded as impractical in view of the totally different operating conditions. To find a practical, inexpensive test, various laboratory methods of accelerated oxidation were examined.

Continental Oxidation Test Selected as the Most Suitable

After examination, the Continental oxidation test (a modification of the Indiana oxidation test) was selected as an accelerated oxidation test for classifying hydraulic oils. Operating temperatures in a hydraulic system will not even approximate the 341 degrees F. used in this test. We might reasonably assume, however, that an excessive amount of naphtha insolubles at the conclusion of this test would indicate that such an oil would be more likely to produce troublesome oxidation products in service than one having less naphtha insolubles. Then, too, as it has been found that the acid value of used oil is inversely proportional to its demulsibility, we may use this value as a yardstick of comparison.

The use of an iron wire catalyst in this test helps us to more nearly predict the service characteristics, in view of the presence of metals in the hydraulic circuits. Further, the action of bubbling air passed through the heated sample of oil parallels the turbulent action of trapped air in hydraulic oils when in use.

Procedure in Making the Continental Oxidation Test

In this test, the standard Indiana oxidation test apparatus is used. First, 160 milliliters of the oil is placed in a pyrex test tube having dimensions specified for the Indiana oxidation test, along with 9 feet of No. 18 gage annealed "wool" wire, which has been polished with emery cloth prior to winding it into a coil. The specifications covering its contents, other than iron, are as follows: Carbon, 0.08 per cent; manganese, 0.87 per cent; sulphur, 0.037 per cent; phosphorus, 0.082 per cent; and silicon, 0.005 per cent. The approximate diameter of the wire is 0.062 inch.

The wire is thoroughly cleaned by polishing with emery paper and then formed into a coil approximately 5 inches long and 1 1/2 inches outside diameter. The coil rests on the bottom of a standard Indiana oxidation test tube, and is entirely submerged in the oil at the start of the test. The test tube is placed in the bath and maintained at a temperature of 341 degrees F., plus or minus 1 degree; it is placed in such a position that the level of the bath is at least 1 1/2 inches above the level of the oil in the tube. Air is blown through the oil at the rate of 10 liters per hour.

A 10-gram sample is obtained for naphtha insoluble determination at twenty-four hours. At forty-eight hours, the entire sample is withdrawn and a viscosity determination at 210 degrees F. is made. Two 10-gram portions are weighed out and the remainder returned to the oxidation tube, provided the test is to continue. The naphtha insoluble matter is determined on one of the 10-gram portions, and the Conradson carbon on the other. If, at the end of forty-eight hours, either the viscosity increase exceeds 10 per cent or the naphtha insolubles exceed 10 milligrams, the test is concluded; otherwise oxidation is continued for another twenty-four hours, and viscosity, naphtha insoluble, and Conradson carbon determinations are repeated at the end of the seventy-two-hour period.

The amount of naphtha insolubles (in milligrams) is determined by the following method: Ten grams of oil are dissolved in 100 milliliters of A.S.T.M. precipitation naphtha and allowed to stand for at least one hour; the solution is then filtered through a gooch crucible and washed with 100 milliliters of A.S.T.M. precipitation naphtha. Next, the gooch is dried in an oven at 125 degrees C. for one hour and cooled and weighed, and the milligrams of naphtha insoluble per 10 grams of oil are recorded.

The time required for the formation of 10 and 100 milligrams of naphtha insoluble is estimated by plotting the values determined on logarithmic graph paper (log.-log.) and drawing a straight line through them. The viscosity at 210 degrees F.

and the carbon residue of the original oil are also determined. The per cent viscosity increase at 210 degrees F. is calculated from the data obtained from the sample at the forty-eight-hour period (and at the seventy-two-hour period when this is necessary).

Field Results Checked with Laboratory Results

In order to check field results with laboratory analysis by the Continental oxidation procedure, field samples of two oils in similar service were examined. Oil (1) gave satisfactory field service, while oil (2) deposited gums in the machine tool in appreciable quantities. Examination of the lines, valves, and reservoir used for oil (1) revealed a clean system. Oil (2) produced light deposits on the valves, and the reservoir showed light deposits of gum. Both machines were used in identical service on the same operation, and run at the same temperatures. Both machines were thoroughly cleaned prior to the test. The drain analyses showed similar solids, and the sludge values, both very low, indicated the same amount of contamination during the test period.

Following the field findings, samples of both of the original oils were tested by the Continental oxidation method. The original "paper" specifications of these two oils were as follows:

Physical Analysis

	Oil (1)	Oil (2)
Viscosity at 100 degrees F.	295	317
Viscosity at 210 degrees F.	51.2	51.5
Viscosity Index (D & D)	90	81
Gravity A.P.I.	27.5	26
Flash Point	385	400
Fire Point	455	455
Carbon Residue	0.18	0.11
Neutralization Number	0.05	0.03

As pointed out earlier in this discussion, the values on paper were fairly similar, both oils being apparently well suited for hydraulic circuits. Unfortunately, demulsibility values were not given. The findings in service, however, closely paralleled the Continental oxidation tests.

Continental Oxidation Tests

	Oil (1)	Oil (2)
Original Viscosity at 210 degrees F.	51.2	51.5
Final Viscosity at 210 degrees F.	55.0	61.3
Viscosity Increase, Per Cent...	7.4	19
Final Carbon Residue	0.58	1.32
Final Neutralization Number..	0.50	1.35
Naphtha Insolubles:		
Hours for 10 milligrams.....	39	4.7
Hours for 100 milligrams....	48+	33
Final Insoluble, milligrams ..	15.8	157

Examining these figures, we find that oil (1) was consistent in showing low viscosity increase and the rate of oxidation was fairly constant, having formed but 10 milligrams of naphtha insolubles in thirty-nine hours and 15.8 milligrams in forty-eight hours. The indications of low gum-forming tendencies are borne out by field service tests.

On the other hand, the oil that left troublesome gum deposits in the hydraulic system showed a much greater viscosity increase and a sharp break in naphtha insolubles in the oxidation test between the four- and thirty-three-hour periods. This further substantiates field and laboratory findings that, once oxidation is started in an oil, the rate of oxidation is greatly accelerated, leading to rapid deterioration and correspondingly low usefulness of such an oil for hydraulic circuits.

As previously stated, we cannot definitely say that the oil performance in a hydraulic mechanism will be exactly predicted by this test, nor can we predict the service life of an oil. In the absence of a better yardstick and a more complete method of oil evaluation, however, we believe that the Continental oxidation test for the evaluation of hydraulic oils gives an indication of oil life expectancy that should prove valuable to large users of hydraulic equipment.

Some day a practical evaluation may be devised through the use of an especially constructed hydraulic circuit in which the oil will be subjected to actual operating pressures, temperatures, and conditions simulating those of hydraulically operated machine tools. No one machine tool, or press, could make this evaluation dependable without special equipment, and a series of lengthy tests over widely varying conditions would have to be made. Until the time that such tests are made, however, the author is of the opinion that the method described gives us the starting point in the selection of better blends of hydraulic oils.

Obviously, it is uneconomical for every industrial plant to purchase the extensive equipment necessary for the Continental oxidation test. It is doubtful that more than four or five tests would be necessary. Many of the larger commercial laboratories, however, are equipped to conduct such analyses at a cost that would be but a fraction of the cost of expensive labor and maintenance of machines with inferior oils.

Determining Oil Change Periods

Assuming that we have secured a proper hydraulic oil, we are now confronted with the problem of proper change intervals. Machine tool manufacturers vary widely in their recommendations. Some say every six months, some every three months, some annually, and some conveniently stay off the limb and say nothing.

Experience has proved that there can be no set periods for the change of oil in hydraulic reservoirs. There are too many factors to be considered. The number of hours per working day is, obviously, a primary factor; operating temperatures have a direct bearing on oil deterioration; pressures also play a part; moisture content of the surrounding atmosphere counts; and the ever present possibility of contamination is an important factor. This contamination of oil is a troublesome problem in hydraulic machines. Analysis of reservoir drainings over extended periods of time reveals everything from tobacco to sawdust.

Contamination of Hydraulic Oils

It would perhaps be advisable to list the more common forms of hydraulic oil contaminants in the order of their importance and prevalence: (1) Water; (2) cutting oils and water soluble coolants; (3) sealing compounds and lacquers used in manufacture; (4) other foreign matter.

Briefly reviewing this list, water often is formed by condensation in the reservoir. Moisture-laden air condenses in partially filled or "open" reservoirs of machine tools operated in shops where room temperatures are well below that of the reservoir temperatures. Oil and water mixtures invariably produce sludges, regardless of the demulsibility characteristics of the oil. Those oils having high demulsibility (Herschel) or low steam emulsion number (A.S.T.M.) will provide greater resistance to oil-water sludges.

Usually, condensation is formed in hydraulic systems in very small quantities, and while often present, it is not a particularly serious problem. In most cases, where this condition is prevalent, auxiliary filters will solve the problem and remove sludges as rapidly as formed. The inspection or change frequency of the filter cartridges is, of course, determined by the quantities of water present.

In certain types of machines, the design is such that quantities of coolants or cutting oils often find their way into the hydraulic system. There is little that can be done about this in most cases except to provide the usual guards for coolants and to caution the operator to try to prevent this mixing of coolant and hydraulic oil. These mixtures lead to rapid formation of sludges, with resultant formation of oxidation products of oil. Gums are rapidly formed, and the troubles previously described are met with.

Here, again, auxiliary filters will often aid in solving the problem; but in extreme cases, changing the oil and flushing the system at given intervals, based on careful observation, will prevent serious difficulties with the machine. Fortunately, in the majority of the machines where this condition prevails, soluble oils are used, and the contamination by sulphur-laden cutting oils is the exception, rather than the rule. Sulphurized cutting oils, high in free sulphur content, would, in most hydraulic systems, set up a corrosive action in the pumps and critical parts of the circuit, thus leading to more serious problems than would originate from highly diluted water soluble coolants.

Sealing compounds, lacquers, paints, lead, and other materials used in the manufacture of machine tools have, in the past, presented a serious oil contamination problem in new machines. There are, of course, many sealing compounds and lacquers commercially used that are not oil soluble and that remain intact in the presence of mineral oils and the more widely used additives. The author believes that this problem has been almost entirely overcome by the machine tool manufacturers. Experience from earlier days, however, has taught most maintenance engineers to thoroughly clean reservoirs and lines of a newly delivered machine with a flushing medium. Inspection of the hydraulic oil after the first day of operation is also advised to check for heavier particles not removed in flushing.

The protection of the oil from dirt, grit, etc., is entirely a shop problem. In most cases, machines are so constructed as to prevent "shop dirt" from contaminating the machine, but in some instances careless removal of covers or breather caps may leave the way wide open for almost anything in the shop to enter, if small enough to get into the system.

When moisture is present through condensation in excessive quantities, thus leading to troublesome sludges, temperature and atmosphere conditions should be studied and corrections made to prevent this condition. Where correction is impractical, filter engineers should be consulted for advice as to removal of sludges.

Machines in which the hydraulic oil is affected by the coolants should be checked at frequent intervals—at least weekly—to determine the extent of the contamination. Filter manufacturers should also be consulted for recommendations on machines thus affected.

The quality of hydraulic oil has very little bearing on contamination, but an oil of high demulsibility having high oxidation stability will resist troublesome gums longer than those that are less stable. Thus, upon contamination with a given amount of water or coolant (water soluble mixtures), we can expect a longer delay in ultimate trouble with a highly stable oil than with one of poor demulsibility.

Establishing Reservoir Change Periods

Drain periods can be established with reasonable accuracy by simple titration of drain samples. Several methods are used by various industrial plants. Cooperation with the oil com-

panies will be helpful in establishing testing procedure. The method that seems most suitable for the laboratory of the average concern is the A.S.T.M. test for neutralization number (A.S.T.M. designation: D663-42T). This test is fairly simple and does not employ any special equipment. Laboratory tests of many samples have proved that demulsibility is impaired with high acid values, thus leading to gum formation and retarded separation of oil and air.

Further checks may be made in correlation of gum contents of drainings and acid values. Gum contents are measured by the Kissling resins method. In inspecting a set of over fifty drainings from hydraulic machines in which sludge, solids, gum formations, and acid values were taken, increases in acid values showed a corresponding rise in gums.

Although there is not complete agreement on the subject, it is widely accepted that an oil with a neutralization number of 0.50 or over may well be expected to become troublesome in respect to gum formations, and its use in a hydraulic mechanism beyond this point is not advisable. At least one plant using this method prefers to set the limit to 0.35 as the proper change point.

Removing Rust and Corrosion from Metal Surfaces

IN a report presented to the American Gear Manufacturers Association by its Lubrication Committee, comprehensive information is given on corrosion removal. This section of the report is divided into two parts, one pertaining to non-machined surfaces and the other to machined surfaces.

Removing Rust or Corrosion from Surfaces that have Not been Machined

The method used for removing rust or corrosion will depend on the depth of the corrosion and the type of surface needed after the corrosion has been removed. Scratch-brushing is probably the simplest method, but may leave the surface quite rough. Sand-blasting is effective in cleaning metal surfaces preparatory to the application of most protective coatings under conditions where pickling or other methods of cleaning are impractical or inadequate; sometimes chilled steel shot is used instead of sand. But this method does not remove tightly adhering mill scale nor clean the crevices as well as pickling. It may leave the metal with a rather smooth and less desirable finish.

Corrosion in the form of scale can be removed by pickling, using a 5 per cent solution of hydrochloric acid or a 5 to 10 per cent sulphuric acid solution. The bath is kept at about 180 degrees F. by the injection of steam. The disadvantage of pickling is that a large per cent of the scale comes off first, and while the remainder is being removed, the bare metal exposed to attack is eaten away more rapidly.

It is possible also to cause brittleness of the metal, due to the absorption of hydrogen. If this occurs, the ductility of the metal may be largely restored by heating it in water at the boiling point for several hours in an open tank. Some organic compounds, such as sizing, off-grade flour, or bran, added to the pickle solution, help to keep down acid fumes and to protect the exposed metal from overpickling without reducing the rate of scale removal. Continued agitation and aeration of the pickling bath save time and the amount of acid used.

Electrolytic pickling may be used for special work. The surface of the metal may be cleaned by making it the anode or the cathode (with an insoluble anode) in an electrolyte through which a current is passed. When used as the anode, the rapid solution of the metal and oxygen liberated on the surface loosens the scale. When used as the cathode, the hydrogen deposited on the surface reduces the oxide scale and aids in removing it. This hydrogen may make the metal more brittle than when cleaned at the anode, but the metal is cleaned this way without loss of weight.

Corrosion Removal on Surfaces that have been Machined

Slight amounts of rust may be removed by the use of oil and crocus cloth. For removing a very light coating of rust, there are solutions available on the market that are quite effective. In no instance can it be expected that a smooth, polished surface will be left after any of the above treatments, as the rust coating is never eaten away evenly, and there will be deep pits in some spots. However, surface corrosion should be removed before attempting to cover with any preservative coating, as otherwise the corrosion will continue under the coating, which may cause the coating finally to peel off.

To summarize, corrosion removal may be accomplished by scratch-brushing, sand- or shot-blasting, pickling, electrolytic pickling, or by the use of certain special solutions; but none of these methods will leave the metal surface in its original condition. This is a point that should not be overlooked.

Cold-Treatment of High-Speed Steel Cutting Tools

By FRED W. WHITCOMB, Field Engineer
Deepfreeze Division, Motor Products Corporation

THE improvement in the cutting efficiency of high-speed steel tools through the use of a sub-zero temperature employed as a heat-treating process has made remarkable progress in the last few years. The process has been of sufficient importance to enlist the interest of the research divisions of our foremost engineering colleges, who have studied the structural changes that occur. At the same time, the process is so simple that it can be employed by every user of high-speed steel. A brief review of what has been done up to the present time is in order, and the recording of the experiences of a number of manufacturing concerns will prove of particular interest to tool engineers in general.

The cold-treatment of high-speed steel may be applied after conventional hardening, tempering, and grinding or it may be incorporated in the hardening and tempering cycles. The preferable method is to employ the cold-treatment as a part of the hardening and tempering process; but stock tools that have been hardened and finish-ground may also be treated, and definite cutting efficiency improvement expected.

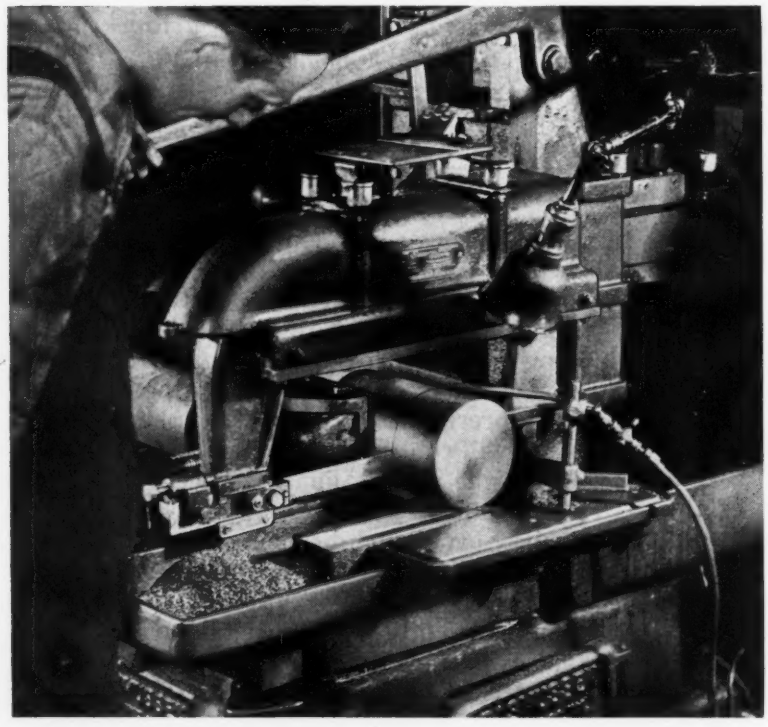
Stock tools that are heat-treated and ground to finished dimensions may be subjected to a temperature of minus 120 degrees F. for a period of from three to six hours, depending upon their cross-section. This treatment is carried out in the low-temperature industrial chilling equipment manufactured by the Deepfreeze Division of the Motor Products Corporation, North Chicago, Ill.

The design of a cutting tool made of high-speed steel will determine the method of applying the cold-treatment. Large sections, very sharp corners, and a high cobalt content are determining factors in anticipating hardening cracks. A tool so designed that these factors are not encountered can be cooled to low temperatures directly from the hardening heat. An alternate practice, to save a tool having irregular design or hazardous analysis, is to temper before applying a sub-zero treatment, and retemper after the tool has reached room temperature again.

Detailed Procedure in Treating High-Speed Steel

The procedure used in cold-treating 18-4-1 high-speed steel, cobalt bearing high-speed steels, and the molybdenum high-speed steels is the same for all; but the preheating and hardening temperatures recommended for each one by the manufacturer of the steel should be observed. The three general procedures now in use are as follows:

Procedure No. 1—(A) Preheat to from 1400 to 1550 degrees F., depending on analysis. (Double preheating is recommended, using from 700 to 1000 degrees F. for the first preheating.) (B) Heat to hardening temperature, depending on analysis (from 2100 to 2400 degrees F.). (C) Quench in oil, lead, salt, or air. (D) Remove from quenching medium at approximately 200 degrees F., and transfer to tempering temperature. (E) Temper for from two to four hours to hardness specification (at 1000 degrees F. minimum). (F) Allow tool to cool to



Cold-treated Hacksaw, the Life of which has been More than Doubled by Deepfreeze Cold-treatment

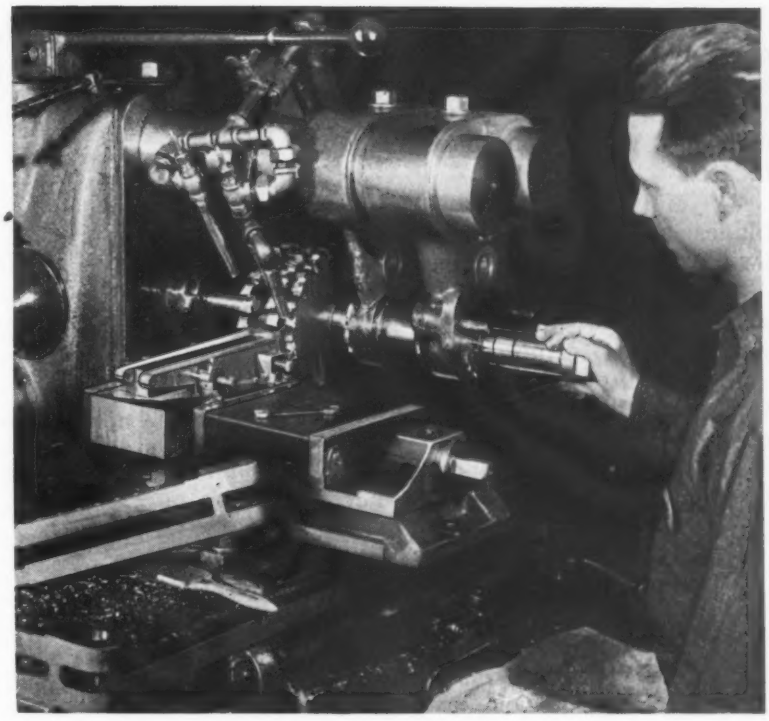
150 degrees F. (G) Cold-treat at minus 120 degrees F. in Deepfreeze chilling machine for from three to six hours, depending on cross-section. (H) Allow part to warm to room temperature normally. (I) Repeat tempering cycle, using 25 degrees lower temperature for from two to four hours.

Procedure No. 2—(A) Preheat to from 1400 to 1550 degrees F. (Double preheat whenever possible.) (B) Heat to hardening temperature of from 2100 to 2400 degrees F., depending on analysis. (C) Quench in oil, lead, salt, or air. (D) Tool can be allowed to air-cool to 150 degrees F. if removed from quenching mediums at higher temperature. (E) Transfer to Deepfreeze unit at minus 120 degrees F. for from three to six hours, depending on cross-section. (F) Allow to return to room temperature. (G) Temper to specified hardness. (H) Transfer to Deepfreeze unit at minus 120 degrees F. when tool has cooled to approximately 150 degrees F. from the tempering temperature. (I) Remove from Deepfreeze unit and allow tool to return to room temperature. (J) Retemper at 25 degrees lower than original tempering temperature for from two to four hours.

Procedure No. 3—During the past year, experiments giving satisfactory results have been carried out by simply heat-treating the tools as usual, grinding them to finished tolerances, and applying a sub-zero treatment for from three to six hours at 120 degrees F. below zero. The tool is then permitted to return to room temperature, after which it is ready for use.

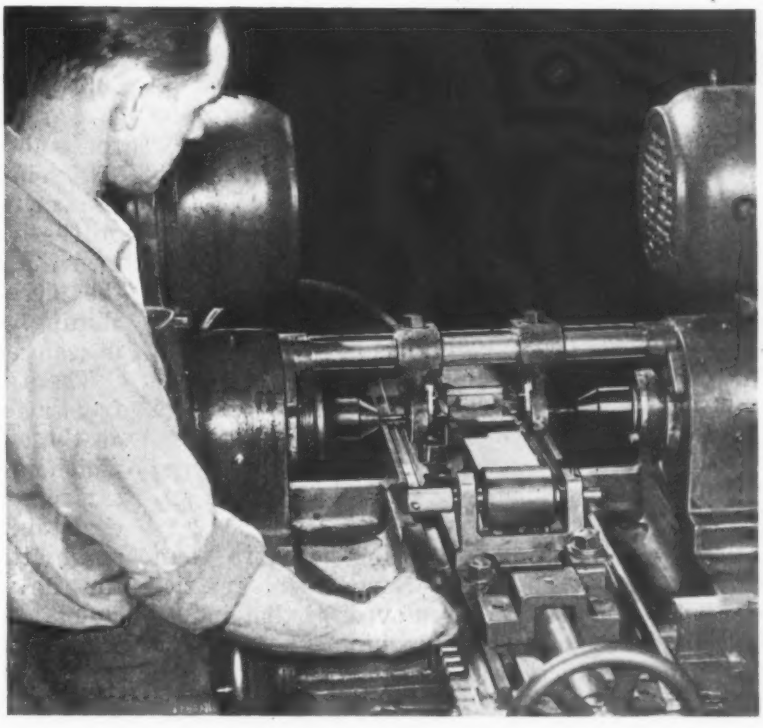
The following is an accurate record of results obtained, indicating the increased efficiency of cutting tools that have been given sub-zero treatment as outlined in Procedure No. 3.

1. Standard drills, 11/32 inch in diameter, drilling holes 1 1/4 inches deep in S A E 4340 steel at 387 to 407 Brinell, drilled an average of 256 holes, as compared with an average of 48 holes when not cold-treated.



Milling Cutters, Formerly Resharpened Every Seven Hours, Require Resharpening Only Every Twenty-four Hours after being Subjected to Cold-treatment

Drills, the Useful Life of which has been Increased as Much as Five Times by the Cold-treating Process



2. Standard milling cutters, mounted in a gang of three, machining the same material as in the preceding paragraph, have run twenty-four hours without requiring regrinding, as compared with seven hours for cutters not cold-treated.

3. Molybdenum high-speed steel hacksaw blades after cold-treatment have lasted over twice as long as formerly.

4. Gear-cutting hobs used for differential gears have shown an increase of from 150 pieces per grind to 510 pieces per grind.

5. On a tapping operation, the average life of taps was 40 pieces; one lot of cold-treated taps averaged 710 pieces.

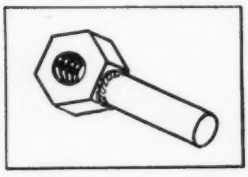
6. Cold-treated high-speed steel burnishing broaches showed an average increase in life of from 216 to 648 pieces.

The hardness of cutting tools may increase perceptibly if the original tempering operation has been incomplete; and should an extremely high hardness develop, it is recommended that the tools be retempered to the usual hardness working ranges. One manufacturer is quoted as saying: "Had the effect of cold-treatment of high-speed steel tools been understood at the beginning of the war, only one-half of the cutting tools manufactured would have been required; and the productive labor used in sharpening tools and in resetting them in machines would have been reduced about one-half, as well.

* * *

Lever Welded to Nut Eliminates Wrench Handling

A simple shop kink developed to speed up war production consists of welding a lever to a nut, as shown in the accompanying illustration. This idea, suggested by the Lincoln Electric Co., Cleveland, Ohio, can be used to advantage wherever machine operations call for repeated tightening and loosening of a nut, as in clamping work for machining. A piece of scrap pipe or round stock can be used for the lever that is welded to the nut.



Nut with Lever Welded to Face for Tightening or Loosening

* * *

Post-war planning really means more than planning to be effective. Government restrictions must be gradually removed, so that industry may have the required equipment ready for peacetime production and employment when the war plants close.

Cleveland Pneumatic Tool Co.'s Fiftieth Anniversary

The Cleveland Pneumatic Tool Co., Cleveland, Ohio, is just celebrating its fiftieth anniversary. The company was incorporated in Ohio, May 29, 1894, as the Union Electric Co., for the purpose of manufacturing and selling electric appliances. It started with ten employes and occupied a factory with approximately 3000 square feet of floor space. In 1899, the corporate name was changed to the present one and the company's facilities were devoted to the development and distribution of pneumatic appliances. It was in that year that the company's first pneumatic riveter and first pneumatic chipper were made and marketed. In 1908, a subsidiary for the manufacture of pneumatic mining and construction tools was organized under the name of Cleveland Rock Drill Co. In the same year, a Canadian subsidiary—the Canadian Cleveland Drill Co., Ltd.—was incorporated. The name of this company was changed in 1912 to Cleveland Pneumatic Tool Co. of Canada, Ltd.

Practically all of the company's peacetime products, which include pneumatic tools, aircraft landing gear, shock absorbers, rock drills, and other mining and construction equipment, are now being manufactured for the war effort.

* * *

Removing Broken Tools from Non-Ferrous Metal Parts

Broken drills and taps can be removed from aluminum, brass, bronze, and copper castings and forgings by a method developed by the Mechemel Engineering & Sales Co., 4313 Lincoln Ave., Chicago 18, Ill. The Mechemel method is an electrolytic process which disintegrates the embedded broken part of the tap or drill. The solution used does not attack the non-ferrous metals and alloys, so that there is no action on the hole or thread. When the broken fragment has been removed through disintegration, the piece of work is ready for continued machining. A unit operating on 110-volt alternating current is used for the process.

The time required for the operation varies from a few minutes to several hours, depending on the size of the broken tool and the metal in which it is embedded. One unskilled workman can remove up to three dozen broken taps at one time, since the operation does not require constant attendance. Different solutions are used for the various non-ferrous metals and alloys. To obtain the correct solution, all that is necessary is to specify the chemical composition or the SAE number of the metal or alloy that is being machined.

Electronic Control and Regulation of Motor Drives

Second in a Series of Articles on the Fundamentals of Electronics and the Ways in which Electronic Devices can be Advantageously Applied in the Mechanical Field

By HOLBROOK L. HORTON

IN the first article of this series, published in May MACHINERY, some of the fundamental terms used in electronics were defined, basic electronic processes were described, and the general industrial application of these processes was outlined. The remaining articles in this series will discuss specific applications of electronic equipment.

One of the most important functions of electronic equipment is that of control and regulation. Since these two terms, *control* and *regulation*, are often confused, it may be helpful to define them as they will be used in this and subsequent articles of this series.

By *control* of a quantity is meant its arbitrary adjustment through some influence not connected with the quantity at all. Thus, a certain quantity is controlled when adjustment is made as a result of an operator's judgment; the passage of a certain predetermined period of time; or the presence or absence of certain unwanted characteristics in articles being inspected on a conveyor line, etc. The principle of control is illustrated by the diagram Fig. 1.

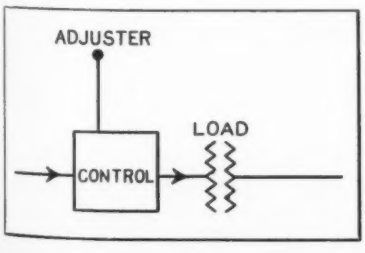
By *regulation* of a quantity is meant its maintenance as close to some constant value as possible by means of a system that automatically corrects errors by feeding the quantity being regulated back into the system. Such quantities as voltage, speed, temperature, etc., may be regulated by electronic means. The principle of regulation is illustrated by the diagram Fig. 2.

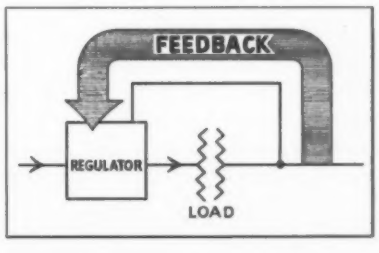
At one time the control and regulation of motor drives in which wide speed range and varying torque were required presented a difficult design problem for machine builders. Now there are two general approaches to this problem that offer interesting possibilities. One is the use of an alternating-current motor with a mechanical speed-changing device, which is either incorporated in the motor or employed as a separate unit. The other is the use of a direct-current motor with electrical means for changing the speed. It is the latter which is of interest in this article because of the electronic nature of the associated equipment.

Two main types of direct-current adjustable-speed motor drives can be operated from a standard alternating-current supply. In one type, the current for the motor is supplied by a direct-current generator, driven by an alternating-current motor. In the other type, current for the motor is supplied by an electronic rectifier. In the first, electronic tubes may be used to regulate the motor speed. In the second, electronic tubes are used for both control and regulation of the motor.

Electronically Controlled and Regulated Direct-Current Motor Drive

Considering the latter type first, the basic elements of an electronically controlled and regulated motor drive are shown in Fig. 3. The four tubes shown in this schematic diagram are of the Thyratron type (see first article of this series) and function as controlled rectifiers to supply direct current to the motor. The two small Thyratron tubes at the left supply direct current to the motor field. The two large Thyra-





Figs. 1 and 2. Diagrams Illustrating (Left) Principle of Control, by which Quantity Controlled is Adjusted through Some Influence Not Connected with that Quantity; (Right) Principle of Regulation, by which Errors are Automatically Corrected by Feeding Quantity being Regulated back into System

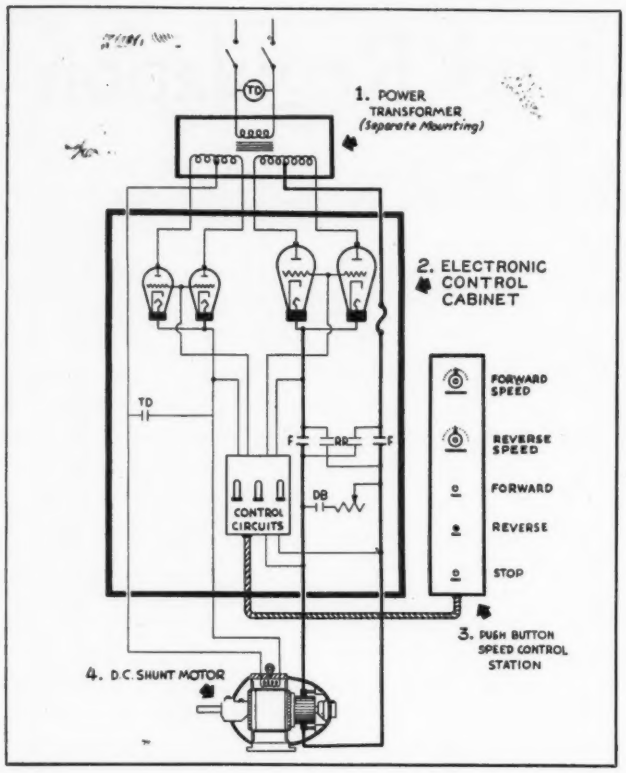


Fig. 3. Diagram of Electronically Controlled and Regulated Direct-current Motor Drive. Vacuum Tubes are of Thyratron Type. Small Tubes Supply Current for Field; Large Tubes Supply Armature

tron tubes at the right supply direct current to the motor armature. It may be noted here that for small control units of 2 H.P. rating and below, single-phase, full-wave rectification is usually employed. For larger control units, some form of polyphase rectifier system, such as two-phase, full-wave, or three-phase, half-wave may be used.

Uni-directional speed control is effected by means of a single dial type control, which is actually a potentiometer controlling both armature and field circuits, mounted in the push-button station with stop and start buttons, as shown in Fig. 4. A modification of this control, shown in Fig. 3, provides three push-buttons for "stop," "forward," and "reverse" with a dial type speed control for forward speeds and another for reverse speeds. No separate line-starter or field rheostat is required.

As shown in Fig. 5, the speed of the motor from minimum to base speed (speed developed by the motor at full load with rated voltage on armature and field) is controlled by turning the speed control pointer through the range 0 to 5. The effect of turning the control indicator clockwise through this range is to increase the amount of voltage applied to the motor armature while maintaining full field strength. This increase in voltage applied to the armature results in an increase in motor speed. From minimum to base speed the motor torque remains constant, while the horsepower output increases correspondingly with the speed.

To increase the speed of the motor above its base speed, the speed control indicator is moved through the range 5 to 10. This has the effect of decreasing the strength of the field while maintaining the armature voltage at a constant value. The characteristics of a shunt-wound, direct-current motor are such that with decreasing field strength and armature voltage held constant, the speed will increase. The motor torque will decrease proportionately, however, resulting in constant horsepower throughout this range.

It should be noted that the motor is always at full field strength when starting, regardless of the initial setting of the speed control. Thus, if the speed control is set for any speed above the base speed—requiring a weakened field—the field will not be weakened until after the motor reaches its base speed.

This type of electronic control provides smooth but rapid acceleration or deceleration in one or both directions as required. The motor speed can be held constant within close limits. It may be preset at any point within the range of the control for repeated operation or it may be changed after the motor has come up to speed.

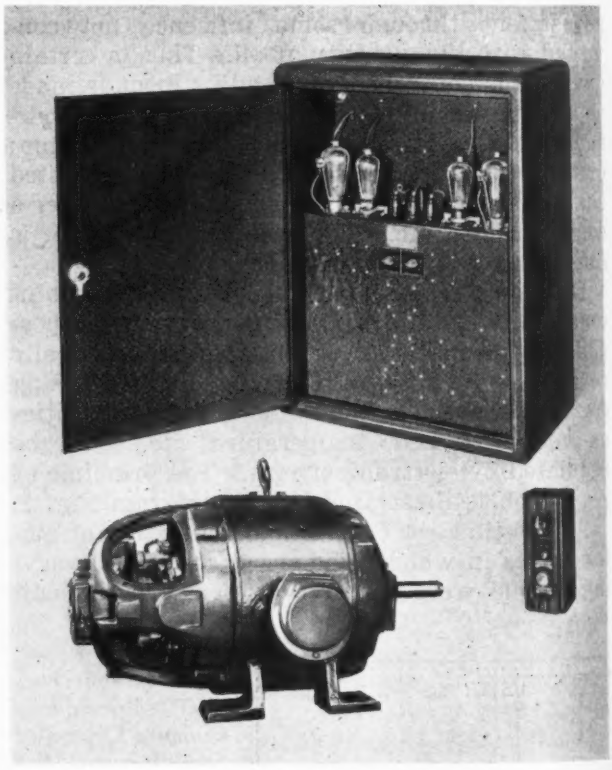


Fig. 4. Three of the Principal Elements of Electronically Controlled and Regulated Direct-current Motor Drive. The Power Transformer is Not Shown

The motor may be preset for one speed in the forward direction and the same or a different speed in the reverse direction. It may be reversed without pressing the stop-button and will automatically run at the preset speed. The control operates to regulate the motor speed so closely that it is practically independent of the load and ordinary line-voltage variations.

This smooth, stepless control of the motor speed may be effected over a range of at least 20 to 1 below and 4 or 5 to 1 above the base speed of the motor, giving a total range of up to 100 to 1. In a properly adjusted system, the speed over a 10 to 1 range below base speed will not vary more than 4 per cent from a preset value, with torque varying from no load to full load, nor more than 8 per cent within the speed range of 20 to 1.

Dynamic braking for quick stopping is usually included in this motor drive. Forward and reverse inching can also be provided by the use of proper relays and the addition of suitable push-buttons to the control station. A current limiting device is furnished which is usually set for a maximum of 200 per cent of full-load current. This provides a starting torque of 200 per cent and a pull-out torque of 150 to 160 per cent. Even when the motor is stalled, it will not draw more than the maximum value for which the current-limiting device is set.

Such a motor drive has interesting possibilities for machine tool applications, as in milling, boring, and grinding machines requiring a wide speed range.

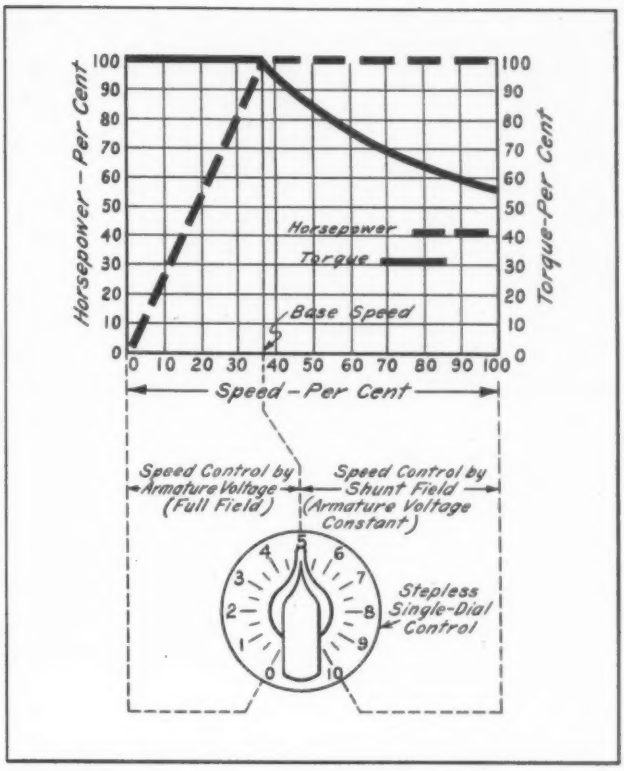


Fig. 5. Through the Speed Range up to Base Speed, the Direct-current Shunt-wound Motor Drive Provides Constant Torque. Through the Speed Range above Base Speed, it Provides Constant Horsepower

Milling Machine Feed-Speed Control

Under normal conditions, the principal load on the feed motor of a standard milling machine is that of friction. With a constant coefficient of friction over the operating range of the machine, the load is very nearly one of constant torque. Referring again to Fig. 5, it will be seen that the electronically controlled direct-current shunt motor drive provides constant torque over a wide speed range, and so is adaptable for standard milling machine application.

On some milling machines, however, the load on the feed motor is not entirely due to friction. Thus, when a heavy slabbing cut is being taken, there may be considerable reaction of the milling cutter against the work. This reaction opposes the feed motion and throws an additional load on the feed motor. Because heavy cuts are taken at low speeds, the feed motor must be capable of delivering greater torque over the lower part of its speed range. Since the load on the feed motor is largely due to friction over the upper part of the speed range, less motor torque is required at the higher speeds.

From Fig. 5, it will be seen that over the speed range above base speed the motor has constant horsepower output (or decreasing torque with increasing speed), while below base speed it has constant torque output. This type of drive is suited for the milling machine just mentioned in that it has the required torque at low speeds without an unnecessary amount at high speeds.

Electronic control has been utilized for the power down feed on a vertical milling machine. With this control, a 1 1/2-H.P. direct-current motor provides a feed range of 1/2 inch to 15 inches per minute for drilling or boring operations. Rapid traverse at 40 inches per minute is also provided. All controls are mounted on a single panel.

Several hundred thread milling machines have been built in which electronically controlled motor drives are utilized to provide a wide range of feed-speeds. Thus the optimum speed for each job can be obtained quickly and accurately, and a rather complicated mechanical system of speed control is eliminated.

This type of electronically controlled motor is also being employed for spindle drives where constant horsepower is required over most of the speed range. Speed control is ordinarily secured by varying the field current of the motor. A somewhat wider speed range can be obtained by introducing some armature voltage control.

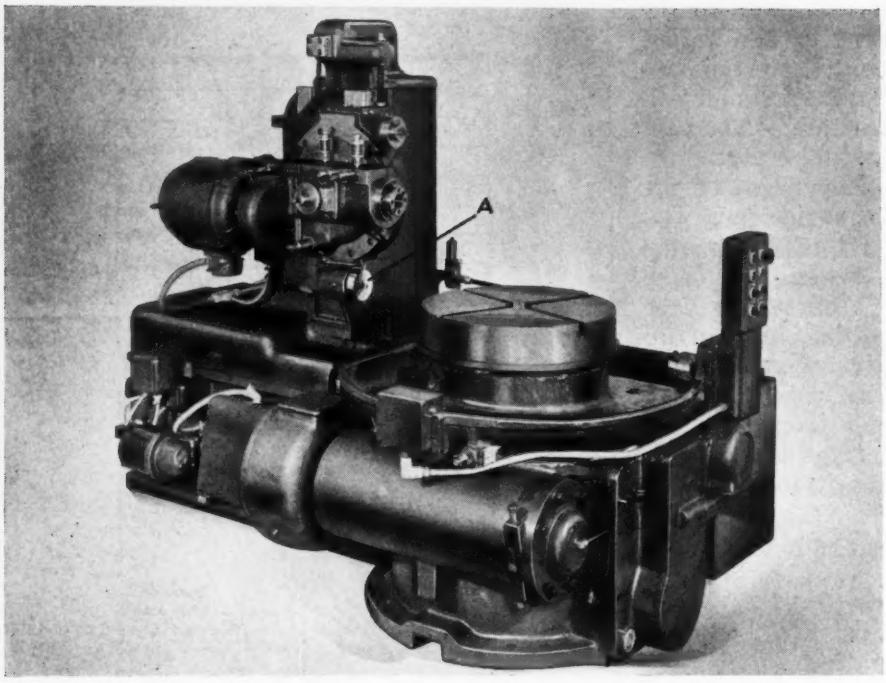


Fig. 6. This Special-purpose Milling Machine for Contour Milling is Provided with an Electronic Table Feed Control to Give a Constant Rate of Feed at the Cutter by Varying the Table Feed through a Cam Mechanism

When the motor speed is to be varied over a repeated cycle, it is advantageous to have this variation effected automatically. One machine tool manufacturer has specified a 4-inch diameter potentiometer for gear drive to take the place of the small potentiometer customarily supplied for manual speed variation.

Automatic Speed Variation

An interesting arrangement for automatic speed variation of an electronically controlled motor drive is shown in Fig. 6. This is a Sundstrand special-purpose milling machine designed to do a specific contour milling job. The electronically controlled motor shown in Fig. 7 is used for the table drive. It has a speed range in the forward or cutting direction of 50 to 1150 R.P.M., which provides a table feed range of from 0.43 inch to 10 inches per minute at the work diameter, which is 23 1/2 inches. In the reverse direction, the speed range is 50 to 2300 R.P.M.

In operation, the column approaches and feeds to a positive stop, the head feeds down until the roller *A*, Fig. 6, engages a cam mounted

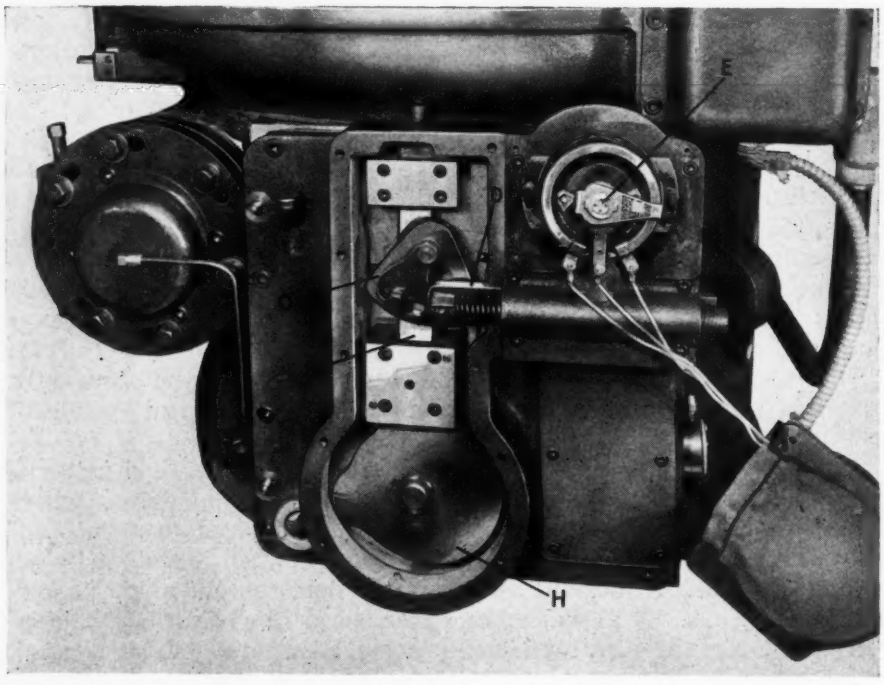


Fig. 7. Automatic Variation of Table Feed Rate with Work Contour Change is Secured by Cam-actuated Rack which Meshes with Geared Potentiometer Controlling Feed-motor Speed

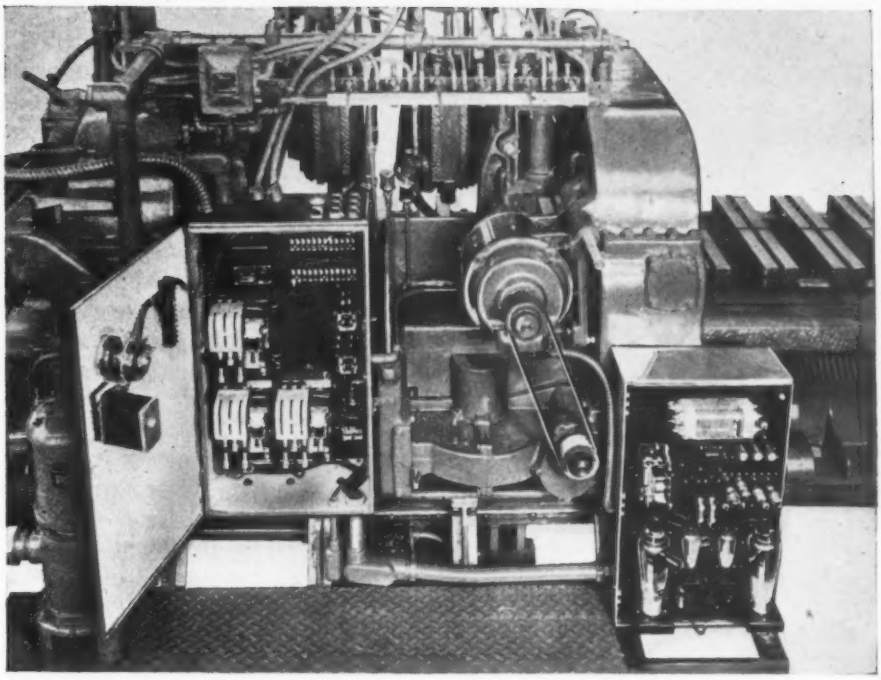


Fig. 8. The Feed of This Traveling Carriage Spar Milling Machine is Automatically Varied with the Depth of Cut by Electronic Control Shown in Cabinet at Right. Cabinet at Left Contains Alternating-current Magnetic Controller

on the rotary table. (This cam is not shown.) The table then rotates in the cutting direction. In the course of one rotation of the table, the head has four rise and fall cycles. At the steepest part of the cutter climb, the actual instantaneous feed rate would be 50 per cent above the table feed rate if some provision for variation in the rate of table feed were not provided. Yet it is necessary to keep the cutter feed rate as constant as possible in order to obtain the desired accuracy in the contour of the work.

Fig. 7 shows how this is done. Cam *H* revolves four times to one revolution of the work-table, since each of the four rise and fall cycles of the cutting head are the same. As cam *H* rotates, follower *B* moves adjustable cam-plate *C*. This, in turn, actuates the rack *D*, which engages a gear on the shaft of the potentiometer *E* by means of which the speed of the table feed is controlled.

The design of cam-plate *C* is such that, regardless of its setting, the full vertical stroke of cam follower *B* changes the table feed in the ratio of 1.5 to 1. At maximum feed setting, the motor speed ranges from 776 to 1150 R.P.M., and at minimum table feed setting, it varies

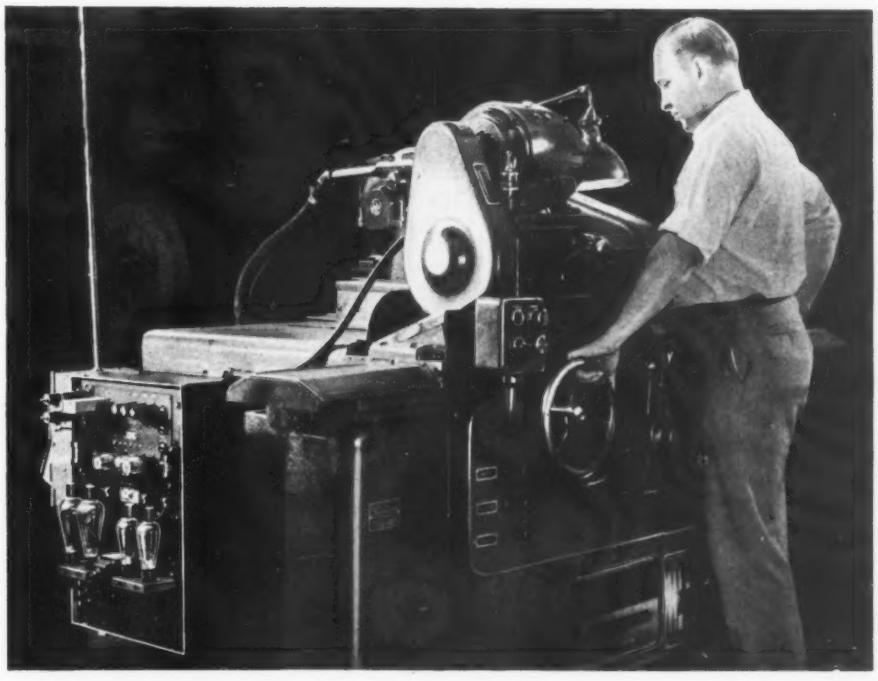


Fig. 9. Cylindrical Grinding Machine Equipped with Electronically Controlled Motor Drive for the Headstock. The Speed Range is 160 to 2300 Revolutions per Minute

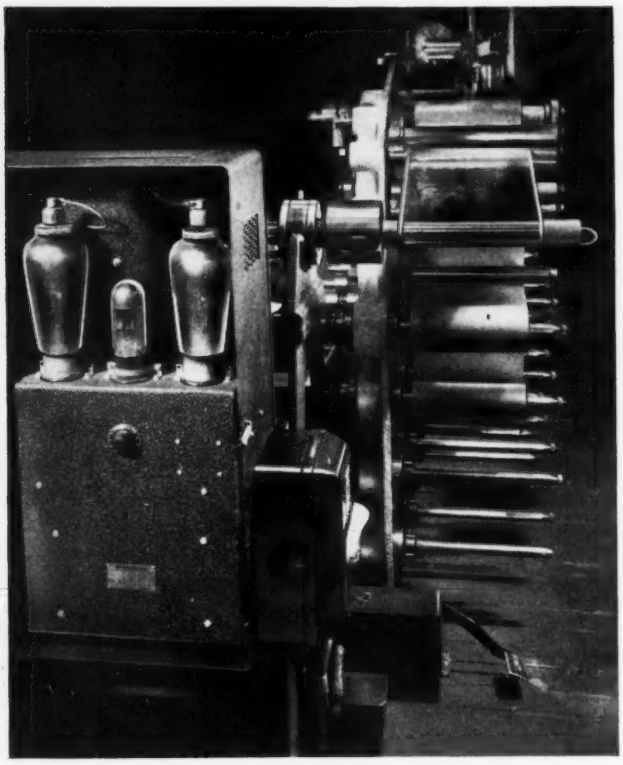


Fig. 10. The Smooth Acceleration and Deceleration Provided by an Electronically Controlled Motor Drive has Made It Possible to Wind Capacitors by Machine without Breaking the Thin Metal Foil

from 50 to 74 R.P.M. At whatever the feed setting, the table feed rate is varied automatically to maintain a constant feed rate at the cutter.

Another example of automatic variation of an electronically controlled motor drive is on an airplane spar milling machine, where the character of the work calls for considerable variation in the depth of cut as the entire length of the spar passes under the milling cutter. Were a constant-speed motor employed for feeding the work past the cutter, the rate of feed for each pass would be determined by the maximum depth of cut to be taken. Thus, the feed would be slower than necessary for the lighter cuts and considerable machine time would be wasted. To provide as close to full load as possible on the spindle motor at all times, an electronically controlled motor-driven feed, shown in Fig. 8, is utilized, which provides the 15 to 1 feed-speed range required.

The speed control unit is operated by means of a follower which moves over a contour bar as the work is fed past the milling cutter. The contour of the bar is designed to vary with the depth of cut. When the cut is heavy, the feed is slow, and when the cut is light, the feed is rapid, increasing still further for skip feed between cuts. In this way, approximately full load is maintained on the spindle motor throughout the milling operation.

The feed on contour milling machines, automatic shapers, or similar equipment can be electronically controlled automatically and directly by the load on the cutter motor instead of through some intervening mechanical means such as that just described. With this arrangement, when the cutter is taking a maximum cut, the feed-speed is at a minimum rate, and as the load decreases the feeding rate increases automatically.

Grinding Machine Applications

Many applications have been made to the headstock drives or the work turning drives of cylindrical grinders. Such applications provide practically a constant-torque drive, since for plunge-cut grinding the characteristics match up quite closely with those described for milling machines. The speed range most commonly used is 15 to 1. This type of drive has made it unnecessary to use certain mechanical components of the drive formerly required, such as intermediate shafts, and other portions of the headstock are simplified. Fig. 9 shows a cylindrical grinding machine equipped with an electronically controlled and regulated motor drive for the headstock. This drive has a speed range of 160 to 2300 R.P.M.

The speed compensation feature of the electronic control is particularly valuable on grinders of this type because the smooth functioning and rapid response of the control provide practically a fixed speed, even under widely changing load conditions. Such close regulation of speed is highly desirable, since otherwise the finished product may show irregularities in the surface.

Surface grinders having a circular rotating table and a reciprocating wheel-head, separately driven, can be electronically controlled so that practically a constant feed is obtained. The conditions required to be met are that as the wheel moves toward the center of the chuck, both the chuck rotation and the wheel-head speed be automatically increased to maintain, within fairly close limits, a constant head feed movement of a specified amount per revolution of the chuck. It is, of course, true that if it is attempted to maintain a constant feed too close to the actual center of the chuck, the required speed would become excessive.

It seems worthwhile to repeat what one engineer has already pointed out, namely, that in considering the application of electronically controlled direct-current motors to grinding machines, the approach should be made from the standpoint of redesign rather than application to the present design. In this way, the advan-

tages of wide speed range, stepless speed variation, and compact control and drive units can be fully utilized to meet the demands for higher production rates, as well as finer finish and greater accuracy.

Rapid acceleration and deceleration of balancing machines with drives rated up to 200 H.P. are being obtained with the aid of electronic motor control. This type of control provides a gradual application of torque and also torque-limit acceleration and deceleration. The maximum torque is held close below the safe operating value for the machine during the accelerating and decelerating periods, and is readily adjustable through a considerable range. The speed adjustment, being stepless, permits accurate and easy adjustment to the exact value required.

With this type of electronic control, the rate of acceleration is controlled by limiting the acceleration current, making the direct-current motor a smooth starting as well as an even running (by virtue of its close speed regulation) source of drive power. One application in which these characteristics are important is a capacitor winding machine, such as that shown in Fig. 10. Here a number of thin sheets of tissue-like paper and tinfoil are wound concentrically around a mandrel. In order to avoid breakage of the paper or foil, the motor drive for the machine must be smooth starting and even running. The electronic control has made it possible to employ a motor drive where heretofore hand-winding was necessary.

Another type of electronic motor speed control has no grid-controlled tubes (Thyratron type) but uses gas diode tubes to rectify the alternating current. This control provides similar advantages to those just discussed, in which Thyratron tubes are employed, including current limited acceleration, reversing, dynamic braking, inching, plugging, etc. The control units are offered in sizes up to 250 H.P., and in the larger sizes are said to be suitable for steel mill drives, oil-well machines, veneer lathes, rubber mills, and heavy industrial uses.

Electronically Regulated Drive

There are many motor control systems where close speed regulation is desired but where there is no advantage in utilizing full electronic control. In such cases, a motor-generator set can be used to furnish the power to a direct-current motor drive, and an electronic regulator to energize the generator field. As shown in Fig. 11, a small indicating generator is attached to the motor shaft. Since its output voltage is proportional to its speed, it acts as an indication of the motor speed. This indicating voltage is applied through an amplifier and regulating circuit to the grids of the rectifying tubes that furnish current to the generator field.

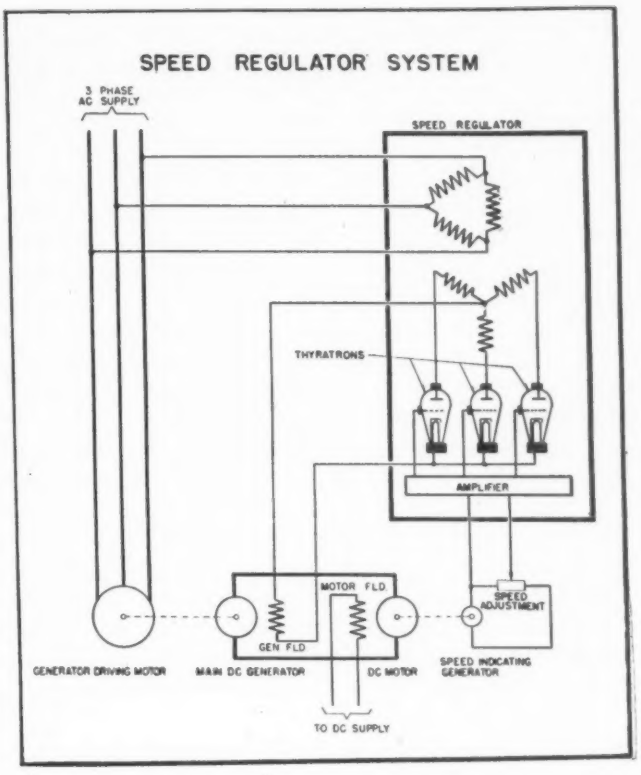


Fig. 11. Here Direct-current Motor Speed is Regulated Electronically by Feeding back the Output of a Small Generator Attached to the Motor Shaft. The Voltage of This Indicating Generator Varies as the Motor Speed

Using this arrangement, the motor speed can be maintained constant within an accuracy of 1/2 per cent, and the speed can be adjusted over a range of 10 to 1. This device is being used for regulating the speed of single-motor and sectional-motor drives for paper machines. A similar device is being employed in connection with the Wright Field 40,000-H.P. wind tunnel drive to maintain constant speed.

In conclusion, it may be said that electronic control and regulation, in combination with direct-current motor drives, afford the following advantages:

1. The alternating-current general-purpose supply can be utilized wherever electrical energy is distributed.

2. Wide speed ranges with stepless control are available in either direction of rotation, which may or may not be independently adjustable as required.

3. Automatic and rapid compensation is made for voltage drop in the direct-current motor between full load and no load, thus maintaining speed fluctuations incident to load changes at a minimum.

4. Current-limiting features are included

which are effective at starting and during accelerating and running, thus protecting the control, the motor, and the driven member. This is in addition to the usual overload protection, which is also included.

5. Operating speed control is effected entirely by one small device, commonly located in the push-button station. Only one speed control dial need be operated to obtain the full range, whether armature voltage or motor field is being controlled or both.

6. Jog may be provided at either the preset speed or at some lower or higher speed, according to the requirements specified.

The manufacturers of electronically controlled and regulated motor drives who have cooperated in supplying material for this discussion are Electron Equipment Corporation, South Pasadena, Calif.; General Electric Co., Schenectady, N. Y.; Reliance Electric & Engineering Co., Cleveland, Ohio; Weltronic Co., Detroit, Mich.; and Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

* * *

Simple Method for Determining Total Depth of Cut for Milling Keyways

By JOHN L. SKEEHAN

Having been asked at various times by men in the shop for an easy method of determining the amount that must be added to the dimensioned depth of a keyway to obtain the total depth of cut required, the writer evolved a method that is easy to use and one that has become quite popular with shop men. Referring to the accompanying diagram, the dimension A, which must be added to the depth C of the keyway to give the total depth E within sufficiently accurate limits for most jobs is obtained by the formula:

$$A = \frac{B^2}{4D}$$

This formula gives the dimension A within very close limits, where D equals or exceeds $4B$, and is an adaptation of a calculation credited to Nathaniel Bowditch (AD 1773-1838), an American mathematician, astronomer, and navigator for use in making celestial measurements. The complete formula derived mathematically, is $A = \frac{B^2}{4D-4A}$. When D divided by B is equal to or greater than 4, A becomes very small in relation to D and may be eliminated from the divisor to obtain the simplified formula $A = \frac{B^2}{4D}$

Taking, for example, a shaft 1 1/2 inches in diameter in which a keyway 3/8 inch in width is to be milled, and applying the formula $A = \frac{B^2}{4D}$ we have $A = 0.02345$, whereas by the square-root method found in MACHINERY'S HANDBOOK, we have $A = 0.0238$. The actual error resulting from the use of the simplified formula, therefore, equals 0.0238 minus 0.02345 or 0.00035 inch. In the case of an 8-inch shaft having a keyway 2 inches in width, the error is 0.002, on the low side, which is less than the tolerance on a shaft of this size. As the ratio $\frac{D}{B}$ increases, the error resulting from the use of the simplified formula diminishes rapidly.

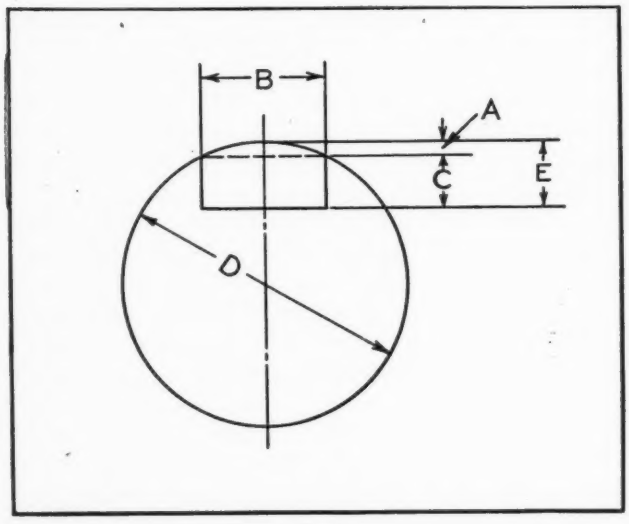


Diagram Showing Method of Determining Depth of Cut for Milling Keyways

On page 552 of the tenth and eleventh editions of MACHINERY'S HANDBOOK, there is a table of dimensions A to be added to the depth C of the keyway in order to obtain the total depth from the outside of the shaft to the bottom of the milled keyway. In milling keyways, the cutter can be fed down to this total depth, no further measurements being necessary. When the table in the Handbook is available, there is little need for the simple formula given here, but Handbooks are not always at hand. The decimal equivalent tables, however, are nearly always available for use when the simplified formula is applied.

* * *

Welded Railroad Freight Cars

Welding, it is believed, will be used extensively after the war to build light-weight railroad box cars. This will save up to 20 per cent in the weight of the cars and increase the payload correspondingly.

How to Secure Fine Surfaces by Grinding

By the Late H. J. WILLS
and H. J. INGRAM, Engineer
The Carborundum Co., Niagara Falls, N. Y.

Thirteenth of a Series of Articles Describing the Factors that Govern Fine Surface Quality and the Means by which This Quality Can be Obtained—The Present Article Discusses the Production Lapping of Ground Internal and External Cylindrical Surfaces

MANY cylindrical parts must be finished by lapping to obtain the required accuracy and surface quality, especially in shops that are not equipped to do the very finest grinding. Small cylindrical parts produced in quantity lots are best lapped on machines equipped with two cast-iron plates. The plates must be kept true by running them together with an FF grit silicon-carbide oil vehicle compound. When trued, the plates are cleaned and run together again with kerosene oil.

In lapping, the compound is applied in small quantities with a brush and kept moist by occasional applications of kerosene, light spindle oil, or machine oil. Aluminum-oxide abrasive of 1000 grit in a grease vehicle is used for very light lapping operations employed to give a polished surface. If an unusually high finish is needed, this procedure is followed by running the plates together with the same compound until the compound is nearly dry, and then inserting the work. The lapping is completed without adding any more oil. Light lapping cuts taken to provide a semi-polished surface are made with 600-grit aluminum oxide in oil, whereas light cuts intended to give a fine matte surface are made with FFFF silicon carbide in oil. For fast cuts, a matte finish is obtained by using the same compound, except that a grit size of FF is used.

Procedure in Lapping Cylindrical Parts Externally

A cylindrical part of any size can be lapped on its external surface by using a small lead wheel having about half the thickness of a wheel such as would be used for grinding the same part. A regular cylindrical grinding machine is used for this work. The wheel must be perfectly balanced and trued, and should be driven at the lowest rotational and traverse speeds available—never more than 2000 surface feet per minute.

Every precaution should be taken to eliminate vibration. Either 220- or 320-grit aluminum oxide is used in oil for this lapping operation. The lead wheel is positioned to merely touch the abrasive grains, and is not permitted to come in contact with the work. When the surface has become true, a high finish can be secured by continuing the operation with the same compound in 800 grit.

Cylindrical parts of from 4 to 8 inches outside diameter are best lapped with a lead lap. The lead is cast around the part in a tapered cast-iron mold. The lap is slit in one place, and is compressed around the piece to be lapped by driving the mold up the taper. The piece is rotated at 300 R.P.M., and is traversed or reciprocated. The compound used is 220-, 320-, or 800-grit aluminum oxide in an oil vehicle, depending upon the surface quality needed.

Cylindrical pieces larger than 8 inches in diameter are lapped with a lead lap that has been bored, turned, or molded to an inside diameter about 0.003 inch larger than the diameter of the cylindrical surface to be finished. This lap is about 6 inches long, and has flat sides and back. The lap, after being split in two and provided with a half-inch gap between the two pieces, is applied to the work by means of an adjustable steel clamp.

The cylinder is rotated in a lathe spindle and the lap is attached to the table, which provides the required longitudinal traverse. The same compound as used for smaller cylinders is applied to the work ahead of the lap, a brush being used to apply the compound. If the lap scrapes the abrasive off the surface being lapped, its edges should be rounded.

Lapping Plungers for High-Pressure Cylinders

Plungers for high-pressure cylinders must have the least possible surface roughness. They must also be round and concentric, with sides

that are straight and parallel within close limits. The plunger is rotated at about 600 R.P.M., using a split cast-iron lap, which is reciprocated over the surface, and 220-grit aluminum oxide in grease as the lapping compound. The plunger is lapped sufficiently to provide clearance between the plunger and the cylinder in the next, or final, lapping operation.

To get the close fit needed, the plunger and cylinder are finally lapped together, using 800-grit aluminum oxide in a soluble oil vehicle. The plunger may be rotated and reciprocated by hand in its cylinder or either part may be rotated in a machine while the other is held in the hand and reciprocated. Speeds are unimportant. When completed, both parts should have an even matte surface.

Lapping the Inner Surfaces of Cylinders

The inner surface of a cylinder with an inside diameter greater than 3/4 inch can be lapped with a honing head whose abrasive sticks are replaced by whitewood sticks or, for a faster cut, with cast-iron sticks. The bore is moistened with compound. If up to 0.0002 inch of material is to be removed, 1000-grit aluminum oxide in grease is used. If 0.0002 to 0.0005 inch must be removed, the same compound in F grit is employed. If 0.0005 to 0.001 inch is to be removed, the same compound in 150 grit is used.

Cylinders of less than 3/4 inch inside diameter are too small to permit a honing tool to be used. For such work, a whitewood lap makes a good substitute for the honing tool. The whitewood lap is turned to approximate size and then split lengthwise. Several thicknesses of abrasive cloth or paper are inserted between the split sections to expand the wood lap to fit the bore quite tightly. Since the insert is placed in the center of the slit, the lap takes a slight barrel shape which keeps it from bell-mouthing the hole. The lap is revolved in a speed lathe at from 100 to 300 R.P.M., while the part is held in the hand and is reciprocated along the lap. The same compounds as recommended for larger cylinders are used for this work.

As air cylinders that are to be used with packed plungers do not need great dimensional accuracy, smooth walls are all that lapping need achieve in finishing such parts. The same procedure and compounds are used as for other cylinders, but the lap is an expanding type tool faced with leather, which is revolved at a speed of about 700 R.P.M.

Lapping Ball-Bearing Raceways

Following the finish-grinding of ball-bearing raceways, a lapping operation is necessary to remove grinder fuzz, surface waves, and chatter marks. The degree of finish secured by grinding determines the time required for lapping. Therefore, as previously emphasized, it is essential that the grinding machine be of good design, well maintained, and skillfully operated.

The several methods used for lapping raceways differ in detail, but are basically the same. The raceways are revolved at high speed and a stationary lap is pressed firmly into the groove. For lapping raceways that are poorly ground and show chatter marks, including heavy-duty types, 90-grit aluminum oxide in a grease vehicle is used with a lead lap. Very heavy pressure should be exerted at the beginning of the operation, and the pressure should be gradually lightened as the operation nears completion.

If the raceway has a fairly good ground surface, a 150-grit aluminum-oxide grease compound is applied with a leather or whitewood lap, using a constant heavy pressure during the entire operation. If the raceway has been given a good smooth grind in preparation for a very accurate job of fine appearance, the same compound is applied with a hard white Mexican felt Grade E lap, maintaining an even pressure.

For very small raceways, any of the laps just described, depending, as stated previously, on the finish developed by grinding, may be used with the same type of compound, but in F grit. An excellent finish may be secured at a slight sacrifice in speed by using a lead lap with F grit aluminum oxide in a soluble oil vehicle. This combination gives a surface free from grain lines. The tools used to hold the laps may be expanding or contracting pliers. For lapping outer raceways, the lap is usually held against the work by means of a stick. Inner raceways are lapped with a lapped-in strip form, which is held against the work by hand.

All types of raceways, with any degree of finish from grinding, should be lapped at a surface speed of about 2000 feet per minute. The time required to remove any waviness in the surface will be materially reduced if the lap is made to provide an arc of contact of at least 35 degrees.

Thrust-bearing raceways can be successfully lapped with a lap made by tacking leather around a circular wooden block, the outer diameter of which is the same as that of the inner edge of the raceway. The leather should be pliable enough to be self-locating in the raceway groove. After lapping, the raceways are washed in a tank containing a mixture of 75 per cent kerosene oil and 25 per cent water at a temperature of 200 to 225 degrees F. They are then rinsed in a second tank containing 75 per cent kerosene oil, 23 per cent water, and 2 per cent sulphonated castor oil. The latter solution leaves a coating of oil on the parts, which acts as an excellent anti-rust if they are to be stored. If

they are to be assembled at once, the castor oil may be omitted. In case tanks are not available, the raceways may be washed by hand with a soft rag or brush.

Methods Employed in Lapping Crankshafts

Crankpins and bearings are lapped to remove grinder fuzz and often to insure accuracy of dimension, parallelism, and concentricity. In large production shops, all of these ends are commonly achieved by using special crank-lapping machines. Some shops, however, prefer to do the lapping by hand.

For the highest accuracy, such as is needed in high-grade automobile and airplane crankshafts, it is advisable to give a preliminary lapping with a split cast-iron lap, using 220-grit aluminum oxide in oil. For ordinary work, this operation is omitted. In both types of work, the following procedure is the final lapping operation, for finish only.

The lap is of the lemon-squeezer type utilizing coated abrasive paper or, preferably, compound. If compound is used, the lap is lined with leather which is moistened with the compound. The crank is rotated and the lap reciprocated or oscillated while applying heavy pressure.

When the crankshafts come to the lapping operation with rough-ground surfaces, the compound used is 90-grit aluminum oxide in grease. If the surfaces are smooth ground, the same type of compound in 150 grit is used. For fine ground surfaces, the same compound in F grit is used. If a very high polish is required, follow whichever operation is indicated with a final lapping, using F grit aluminum oxide in a soluble oil vehicle.

Effective System of Identifying and Keeping Tools in Their Place

AT the plant of the General Tool & Die Co. in East Orange, N. J., an effective yet simple method for identifying the tools that belong to each machine in the shop, and for keeping these tools in their proper place, is being used.

The basic idea of the system is the use of identifying colors. On each machine is painted a small square or rectangle of a certain color, and all the tools (like wrenches, screwdrivers, clamps, etc.) belonging to that machine have their handles or some part of the tool painted the same color — yellow, green, orange, red, brown, etc. Since there are not enough primary colors to use, combinations are also employed, such as stripes of yellow and green, red and green, etc. The color identification, however, is only one part of the system.

Adjacent to each machine there is a board provided with pegs or other supports for the tools. On this board, the outline of the tool is also painted, so that one may see at a glance when a certain tool is missing and know that this tool is a screwdriver or a hammer or a wrench. In that way, the supervisor can see at a glance if any tools are missing.

Each day, before closing time, it is the duty of one of the employes to pass through the shop and inspect all these tool boards to see if any tools are missing. He puts a sheet of paper in the place of the missing tool, noting on it when it was first found missing. If the tool is not returned within two or three days, it is replaced. Usually the missing tools turn up, as someone may have borrowed them temporarily. It is the rule in the shop, however, that the men are not to borrow tools from boards that belong to machines other than those that they are operating.

By this simple method, a great deal of time has been saved in this shop. The men do not need to hunt for tools, because the tools that they require for the operation of their machine are always available and in plain sight. This method of keeping track of tools appears to be wholly original, and is capable of modifications and amplifications that would make it suitable for large and small shops alike.

* * *

Tool Life and Production Greatly Increased by Right Cutting Oil

A manufacturer of 37-millimeter shot produced on six-spindle automatics was disturbed by the low production obtained and the shortness of the tool life. According to a service engineer of the Gulf Oil Corporation, the difficulty was due to the use of an unsatisfactory cutting fluid. By changing to a recommended cutting oil, and by making certain suggested changes in the tooling arrangement, the production was increased threefold and the tool life was increased over six times. This is but one example of the importance of using the right kind of cutting oil. Examples of this kind could be multiplied almost indefinitely.

Engineering News

Equipment Developed for Electric Irons Finds Use in Aircraft

Many items developed for peaceful purposes become of great importance in war manufacture. The little metal disk that is used to control the temperature of electric irons is now serving to put out fires in airplanes. The Westinghouse Electric & Mfg. Co. is producing thousands of thermostats the size of half-dollars for airplane "fire patrol." Attached to motors or to other strategic parts of combat planes, the thermostats operate on the same principle as automatic sprinkler systems used in factories and office buildings.

If a fire starts from a tracer bullet, a leaky gas tank, or an overheated motor, the high temperature causes a bi-metallic disk to move slightly and touch two tiny silver contacts, which close an electric circuit. This action, in turn, causes a light to flash on the pilot's dashboard, telling him which lever to pull to release carbon dioxide to put out the fire.

Photographs with an Exposure of One-Millionth of a Second

Photographs can now be made with an exposure of but one-millionth of a second by means of a new high-speed electronic light equipment developed in the General Electric Co.'s laboratory. With this equipment, a rifle bullet or any other fast moving object can be photographed as if practically stationary.

The device, using a mercury lamp no bigger than a cigarette, consists of a portable box, 10 inches square and weighing less than 20 pounds. On the front is the light source, resembling a small auto headlight, which can be operated manually by means of a push-button or automatically by electrical contacts or a photo-tube and pre-amplifier. It will illuminate 20 square feet of area with sufficient intensity to photograph the fastest moving objects; in fact, in tests, a wheel revolving at 70,000 R.P.M. has been clearly pictured.

The fastest camera shutters of the usual type, with blades moving between the lens elements, ordinarily operate at a minimum of 1/300 second. Focal-plane shutters, consisting of slits in a curtain moving immediately in front of the film, cut this down to 1/1200 second. Recently published high-speed photographs of athletes, etc., have been made with a lamp giving exposures of 1/30,000 second—only one thirty-third as fast as the new device.

Standard and easily replaceable electrical parts and a single electronic tube, with a 100-watt Mazda mercury lamp as the light source, are used in the new device. The ordinary 115-volt, alternating-current, household lighting circuit is employed to operate the unit. The current is rectified by an electronic tube, and then used to charge a capacitor—really an electrical storage tank. In three seconds, enough power is accumulated to operate the lamp at full-flash intensity.

Huge V-Belt Drive Transmits 1500 Horsepower

What is believed to be the largest V-belt drive in the world was recently placed in operation in the flour mill of the Standard-Tilton Milling Co., Alton, Ill. This V-belt transmits power from a 1500-H.P. Corliss steam engine. The twenty-one belts weigh approximately one ton. The installation was made by the B. F. Goodrich Co., of Akron, Ohio. Each of the twenty-one belts is 2 1/2 inches wide at the top, 1 1/4 inches thick, and operates on 18-foot centers. The engine sheave is 18 feet in diameter, the countershaft sheave 7 feet in diameter, and the idler pulley 5 feet.

Automatic Weighing Device for Sorting Bullets and Shells

What is known as a "dynamic classifying device" for automatically classifying and sorting 0.30- and 0.50-caliber armor-piercing bullet cores and 20-millimeter shells has recently been developed by the Toledo Scale Co., Toledo, Ohio. The pieces to be weighed or classified may be spherical, cylindrical, rectangular, or of any regular shape, so long as normal variations in weight do not affect the position of their center of gravity. Parts weighing from 1/4 ounce up to 6 ounces can be handled. Pieces can be weighed and sorted at a speed of from 35 to 40 a minute. They are sorted within an accuracy of 1/2 grain, a remarkably small weight tolerance for parts of this kind.

The parts to be sorted are poured into a drum or hopper on the top of the device. As the parts are fed into the device, they are automatically

deposited on the end of a lever; the loaded end of the lever is released, permitting that end to fall. Thus the parts are weighed in motion, and the interception of a light ray by the weigh beam causes a photo-electric cell to operate a mechanism for automatically discharging the parts into one of three chutes representing under-weight, weight within tolerance, and over-weight.

Unusual Application for Shotgun Shells

According to Thomas Boak, works manager of the Winchester Repeating Arms Co., shotgun shells have been substituted for storage batteries for starting airplane motors during testing. Whereas a storage battery provides a continuous flow of electrical energy to operate an engine starter, the shot-shell delivers a single powerful impulse, which starts the engine.

The airplane starter cartridge is similar in appearance to a standard shot-shell, but longer. Placed in the starter mechanism, the cartridge is fired electrically by a fuse assembly in the head of the shell. Electrical current ignites the charge of black powder in the shell and releases powerful gases, which set the starting mechanism in operation.

Stitching Wire Aids Aircraft Fabrication

Savings in time ranging up to 90 per cent in the production of various aircraft sub-assemblies have been made possible by the development of a new type stitching wire by the American Steel & Wire Co., Cleveland, Ohio. The wire permits the fastening of various types of material, such as rubber, plastics, fiber board, laminated wood, and other construction materials, to stainless steel or aluminum at the rate of several hundred stitches per minute. The fabrication of non-stressed parts, the application of rubber sealing to hatch doors, landing-gear doors, and similar parts, the lining of heating ducts and shrouds with asbestos, and the sewing of cold air ducts, first-aid kits, and ammunition boxes into their proper places have all been greatly facilitated by this stitching wire.

The new wire is of a special analysis and has a guaranteed minimum tensile strength of 290,000 pounds per square inch. It has a zinc coating which withstands a salt spray for a period of several hundred hours, in accordance with Army Air Corps specifications. The wire is 0.051 inch in diameter, and will penetrate stainless steel of 0.030 inch thickness, duralumin of 0.040 inch thickness, or aluminum of 0.060 inch thickness. Other softer materials, such as rubber, wood, asbestos, cork, etc., can be penetrated up to a thickness of 3/4 inch.

Vibration-Dampening Mountings Made from Synthetic Rubber

The vibration-dampening rubber mountings made by the B. F. Goodrich Co., Akron, Ohio, under the trade name "Vibro-Insulators" are now being made from Ameripol synthetic rubber. These mountings, which have been used for isolation and insulation of vibration, shock, and noise, have been made for several years by using natural rubber bonded to metal. The Ameripol synthetic-rubber mountings are expected to find even wider application than the natural rubber mountings, since the synthetic material is suitable for use where the action of oils, grease, paints, fatty acids, or heat would result in too rapid deterioration of natural rubber—thus indicating one advantage of synthetic rubber.

What is Believed to be the World's Largest All-welded Trolley Frame for a Heavy-duty Steel Mill Type Crane of 150 Tons Capacity is Shown as it was Constructed at the Plant of the Cleveland Crane & Engineering Co., Wickliffe, Ohio. The Frame Alone Weighs 32 1/2 Tons. It is over 23 Feet Long and 15 1/2 Feet Wide. To Construct it, 276 Pieces of Various Thicknesses from 3/8 Inch to 2 Inches were Welded together

Editorial Comment

Many of the difficulties that industry has encountered in its relations with Government and with labor leaders have been caused by the attitude of aloofness from public affairs that has characterized the majority of business and industrial leaders in the past. Then, when industry has been attacked—no matter with how little justification—it has found itself on the defensive; and being on the defensive, public opinion has generally been influenced against industry.

Industrial Leaders Must Become Active in Public Affairs

The men who manage business and industry cannot afford simply to be on the defensive if they expect to hold their own in our complex national structure, any more than an army can expect to win a war by simply defending itself against attack. Industry must establish its place as one of the cornerstones of our national structure by an active, aggressive attitude. Political leaders have established themselves in the public mind in that manner. Labor leaders have come to occupy a powerful position in public life by their aggressive attitude. Business and industrial leaders must similarly impress themselves on the public mind.

They must make clear to the public what industrial management has done for the nation—how, through its efforts, America has become what it is, not only industrially, but in scores of other directions. It is through the ingenuity, courage, and efforts of industrial management that this country has achieved its prosperity and its high standard of living, which, in turn, is reflected in the character of our educational institutions, our health services, hospitals and medical progress, our libraries, and scores of other social activities that have made life for everybody easier and richer.

Industrial leaders have been too prone to devote all their energies to the creation of the things that have brought our standard of living to this high level. To produce more goods for more people at less cost has been their primary endeavor. In performing this truly public service, they have to a large extent, however, overlooked the fact that in a democracy, everyone must take an active part in national affairs; otherwise, political leadership will fall into the hands of the self-seeking, unscrupulous, and, frequently, incompetent.

More Goods for More People at Less Cost is Only Half the Job

The war is bringing many industrial and business leaders to Washington to help solve the problems that have been in a hopeless tangle. When the war is over, these men could give invaluable service to the nation by not turning all of their energies back to private business, but giving some of their time to the solution of public problems and the guidance of national trends. Of recent years, there have been too many men in public life engaged in tearing down the old without building a better new structure. In the future, we need men who will not tear down until they know that they can construct and build something better on a firmer foundation.

★ ★

The incomes of industrial workers in the United States are the highest in the world, mainly because the output per worker is higher than in any other country. According to Stevenson, Jordan & Harrison, management engineers, American factories produced, in 1939, twice as much as in 1914, with a labor force only one-fifth larger. This accomplishment was the result of improved organization, more and better equipment per worker, greater use of mechanical power, improved mechanical methods, and simplification and standardization throughout industry.

Increasing Output per Worker through Incentive Payments

If the labor cost per unit of product is to be reduced so that goods can be offered in the market at reasonable prices, while the hourly rates of pay are kept at the level at which they will be at the end of the war, the productivity of labor must be increased. One method of doing this is to create proper incentives for labor to increase output, thereby stimulating the desires of every man and woman to put forth the best effort of which they are capable.

Machine Tool Builders Discuss Current and Post-War Problems

THE spring meeting of the National Machine Tool Builders' Association, held in Cleveland, Ohio, May 8 and 9, was attended by a larger number of machine tool manufacturing executives than any previous meeting.

The sessions were opened by the president of the Association, James Y. Scott, president of the Van Norman Co., Springfield, Mass. In his address, Mr. Scott reviewed a number of the problems that face the machine tool builder at the present time. He also emphasized the importance of common-sense Government policies to prevent serious unemployment when the war ends and before the civilian production reaches its full volume.

James Y. Scott, President of the National Machine Tool Builders' Association

One of the important things right now would be for the Government to permit the machine tool industry to begin the manufacture of machine tools for post-war civilian production, in cases where such machine tool manufacture would not interfere with the building of machine tools for war use. If the Government followed this policy, it would enable the industry to be constantly ready to meet the sudden and varied demands of the armed services, since it would permit the machine tool builder to maintain his operations on a higher level than would otherwise be the case.

Safeguarding Post-War Employment

Furthermore, the manufacture of machine tools for civilian production would permit manufacturers of civilian goods to start re-equipping today for post-war production and in that way, lay a practical foundation for immediate post-war employment.

This point is of the greatest importance. Employment must be kept on an even keel in so far as that is possible. It would be the greatest calamity if war production should stop all of a sudden with no provision for taking up the slack through planned civilian production. This would mean that war workers would be thrown out of work just at a time when many of the men in the armed forces were returning and looking for jobs. The ideal procedure would be an orderly transition from wartime to peacetime production, with peacetime production starting and accelerating as war production tapers off. In that way, a shift from wartime to peacetime production could be made with as small an effect on employment as possible.

This shift requires, in the case of many manufacturers, machine tools of a type that are not available in the war production plants. It has been stated that General Motors alone will need to place 30,000 machine tools in its plants when swinging from war to peacetime production. Approximately 10,000 of these machine tools are available in the various General Motors plants and in storage; but 20,000 machines must be obtained from the machine tool manufacturers.

Concluding his remarks on post-war employment, Mr. Scott said: "If manufacturers converting to peacetime products have to wait until armistice day before they can start any reconversion at all, what will happen to employment in this country? I cannot imagine any worse chaos than that which would result if all re-equipment for conversion were delayed until the day of the armistice.

"Fortunately, any such possibility does not seem to be within the bounds of reason, because as far as we can see today, the war is not going to end with a clean-cut armistice. The transition from war to peace may take several years. The point is, however, that the nature of this transition period should be recognized today, and machine tool builders should be allowed to begin right now to fulfill their normal part in the orderly arrangement of this period of transition."

Manufacturing Costs Must be Reduced in Post-War Years

Mr. Scott also called attention to the fact that, after the war, reduction of manufacturing costs is going to be the biggest problem in the entire industrial field. Wages will not come down; and if prices keep on going up, there will be no large markets for manufactured products, and it will not be possible to sustain high-level post-war employment. The machine tool builder must help the product manufacturer reduce his costs.

"Is it heresy to suggest," asked Mr. Scott, "that new machine tools might even help to cut the costs of war production and thereby lessen the expense to the taxpayer?" Through improved machine tools and manufacturing equipment, American manufacturers can continue, after the war, to pay high wages, and at the same time, will be able to put their products on the market at prices that the masses of the people in this country and abroad can afford to pay.

The Contract Termination Problem

The general manager of the Association, Tell Berna, in his report reviewed the machine tool situation in this country and abroad, and briefly touched upon various important problems of the machine tool industry, including the handling of contract terminations. On the proper handling of this matter depends to no small extent the industry's hope of maintaining employment and of providing jobs for returning service men.

Another problem dealt with was the gradual elimination of old and obsolete machine tools. This can best be done through the annual expenditure of the depreciation reserve of manufacturers for buying new equipment to replace the obsolete. Substantial appropriations from profits in good years would also help to keep manufacturing equipment at a level that would result in the lowest possible production costs.

An exhaustive address on "Developments in Renegotiation" was presented by A. G. Bryant, vice-president of the Cleereman Machine Tool Co., who is chairman of the Government Relations Committee of the Association. John S. Chafee, director of the Tool Division of the War Production Board, spoke on the work of this Division, and William F. Kelly, price executive of the Machinery Branch of the Office of Price Administration, spoke on machine tool prices.

The disposition of Government-owned machine tools was dealt with in a report by William P. Kirk, vice-president of the Pratt & Whitney Co. Mr. Kirk, who is chairman of the Association's Committee on Planning, called attention to the tremendous output of the machine tool industry since the beginning of the war. He mentioned that peace production gets along with approximately 900,000 machine tools in the United States, but to win a modern war, the country needs at least 1,800,000 machine tools. It took the industry five years to reach this high level.

Mr. Kirk outlined the general principles to be considered in the disposal of the excess volume of machine tools. In this connection, he pointed out that we have over 600,000 machine tools in this country that are over fourteen years old. It is estimated that when the war is over and the permanent requirements of the armed services have been met in regard to equipping arsenals and Navy Yards, there still may be some 400,000 machine tools available that were built for war production. Some of these machines are special in character, but the large majority are of what we generally call standard types.

Walter K. Bailey, vice-president of Warner & Swasey Co., who is chairman of the Association's Committee on Sales and Service, presented an exhaustive address, entitled "New Questions on Sales and Service."

An interesting and valuable feature of the convention was an address with motion pictures by Harold T. Johnson, director of the Standards Section of the General Motors Corporation. Mr. Johnson pointed to design features in machine tools that should be changed to be more convenient to the user. He particularly emphasized how in many otherwise satisfactory machine tools certain vital parts, like motors, piping, etc., are enclosed in such a manner as to be practically inaccessible. He suggested ways and means of overcoming some of these difficulties.

Industry Pays Tribute to Mason Britton

At a dinner meeting held in conjunction with the convention, Mason Britton, vice-president of the McGraw-Hill Publishing Co., was presented with a plaque as a tribute to his services in connection with the war production program. Mr. Britton became chief of the Tool Section of the National Defense Advisory Commission in July, 1940, and chief of the Tools Branch of the Office of Production Management in January, 1941. He is now chairman of the Machine Tool Committee of the Combined Production and Resources Board of the Office of War Mobilization.

The plaque, which will not be cast in bronze until after the war, has the following inscription: "Under his direction, the machine tool builders of America, mobilized for the battle of production, delivered to the United Nations for the production of war materiel the largest and most diversified aggregation of machine tools the world has ever known. Presented in grateful acknowledgment of his selfless and untiring service to his country by the National Machine Tool Builders' Association."

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Positive Reciprocating Mechanism

By CHARLES F. SMITH

Machines of certain types sometimes require feeding slides that are given a positive, accurately timed, reciprocating motion with a dwell at each end of the stroke. In the case of the mechanism shown in Fig. 1, the feeding slide *S* is required to be positively locked in the position indicated by the full lines while driving shaft *T*, rotating continuously in one direction, completes a certain portion of a revolution, following which the feeding slide *S* is moved to the position at the right indicated by dotted lines. The slide then remains locked in this position for a certain portion of a revolution of shaft *T*, after which it is returned to the position shown by the full lines. This cycle is repeated continuously as long as the driving shaft *T* continues to rotate.

While it would be possible to obtain a reciprocating and dwell motion of this kind by the use of simple cams, the usual cam and follower arrangement would not insure the necessary positive locking action, accurate positioning during the dwell period, and freedom from lost motion or backlash provided by the mechanism illustrated. As shown in the view to the right, the mechanism consists of two units—the driving crank unit shown at the right-hand end of the assembly or section view, and the Geneva dial mechanism indicated at the left-hand end.

Members *D* and *E* are laid out as a six-station Geneva motion, which allows *D* to revolve through an angle of 240 degrees while *E* remains stationary in either one of the two positions. This provides for the rotation of *D* through an angle of 120 degrees while transferring *E* from one dwell position to the other.

Reversal of member *D* after completing one

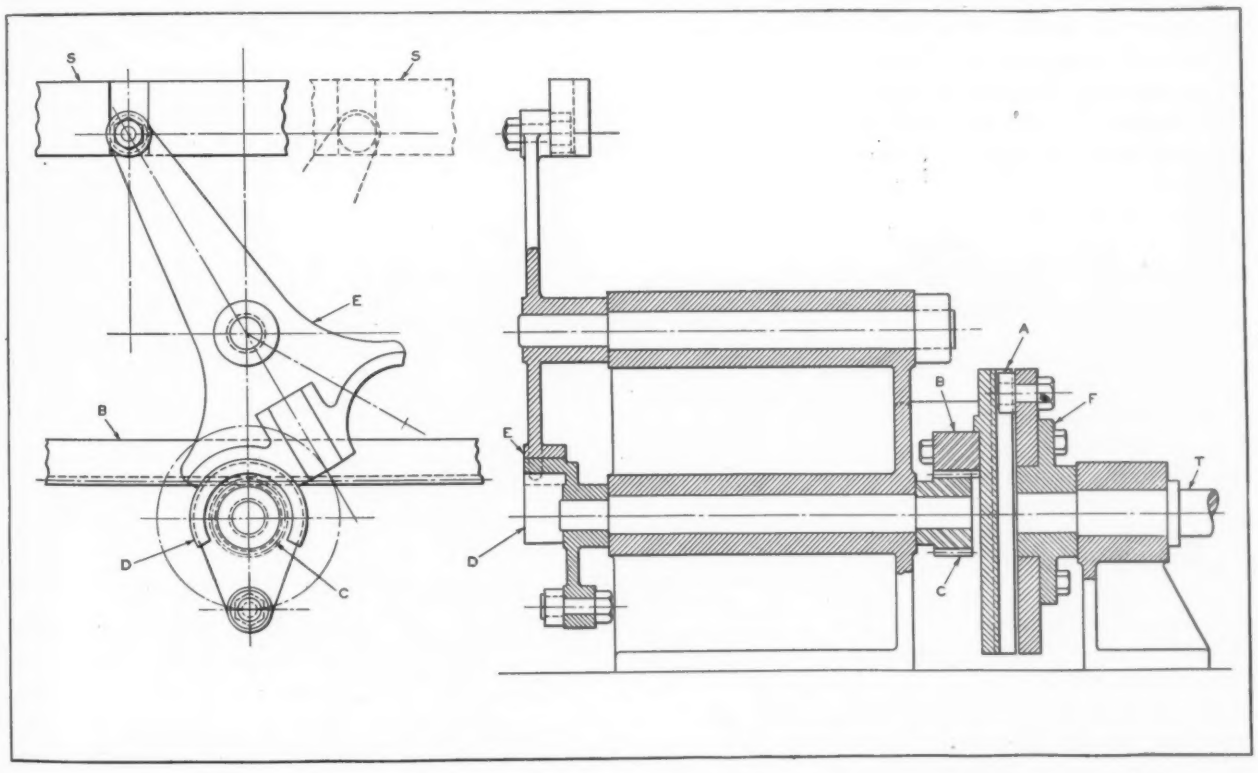


Fig. 1. Mechanism by Means of which Continuously Rotating Shaft T Causes Slide S to Reciprocate with a Dwell Period at Each End of Stroke

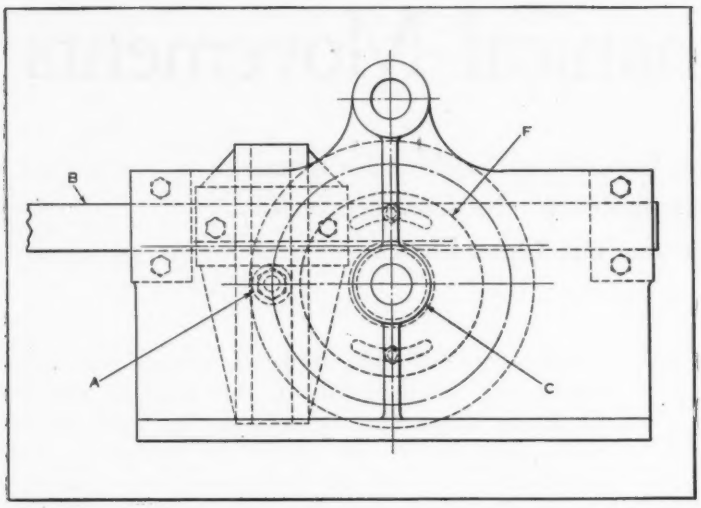


Fig. 2. End View of Mechanism Illustrated in Fig. 1

revolution, as required to give slide *S* the reciprocating movements and dwells described, is accomplished by a crank with a roller *A* which revolves continuously with shaft *T*. Roller *A* engages a vertical slot in a member attached to rack *B*, as indicated in Fig. 2. Rack *B*, in turn, meshes with a pinion *C* on the shaft on which member *D* is mounted.

Thus continuous rotation of shaft *T* causes rack *B* to reciprocate, driving *D* first in one direction and then in the other. Rack *B* rotates driver *D* one full turn during one-half of a revolution of shaft *T*, and then reverses and drives it one full revolution in the opposite direction. Flange *F*, to which the disk carrying the driving roller *A* is attached, has elongated slots for the fastening studs in the flange to permit adjusting the angular position of roller *A*.

Crank Motion with Rest Period

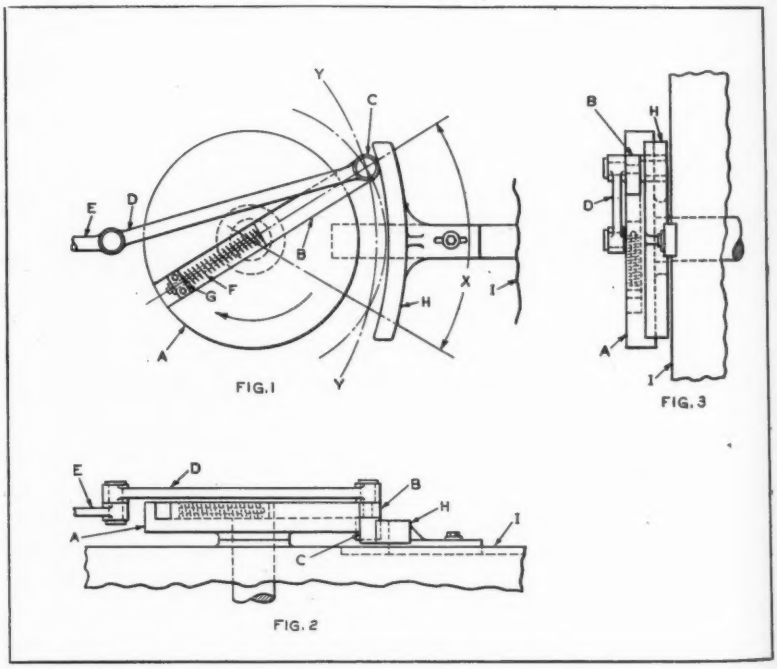
By L. KASPER

A crank motion with a dwell or rest period, designed for use on a wire forming machine, is shown in the accompanying illustration. This mechanism imparts a reciprocating movement to a part in the usual accelerating and decelerating cycle manner, except that a rest period is provided at one end of the stroke.

Referring to Fig. 1, the disk *A*, rotating in the direction indicated by the arrow, carries the bar *B* in a slot in which the bar slides freely. Bar *B* is retained by a cover plate (not shown), and is held in its extreme outer position by the spring *F*, carried on a rod that passes through the block *G*. The nut on the end of this rod restricts the movement of bar *B*, and is used for making slight adjustments. Bar *B* is connected at its outer end with the rod *D*, which, in turn, is connected to the rod *E* to which the reciprocating motion is to be imparted by rotation of disk *A*.

The roller *C*, Fig. 2, carried on the under side of bar *B*, makes contact with the guide *H* during a portion of the cycle. Guide *H* is adjustably mounted on the stationary part *I* of the machine. The contact surface of guide *H* is formed to an arc of a circle having a radius equal to the center-to-center distance of the studs on rod *D* plus half the roller diameter.

Again referring to Fig. 1, the rotation of disk *A* normally carries the center of roller *C* in the circular path indicated by the dot-and-dash circle. However, as roller *C* contacts guide *H*, it cannot continue its normal path, but follows the path of the face of guide *H*. As this surface is formed in the arc of a circle that has its center on the center of the stud connecting rods *D* and *E*, rod *D* at this point rotates on this center, and there is no movement of rod *E* until roller *C* again leaves guide *H*. This causes a shortening of the stroke equal to the distance shown between the two arcs, and produces a rest period for rod *E* equal to the angle *X*.



Figs. 1 to 3. Crank Drive for Reciprocating Slide that Provides Dwell at One End of Stroke

Westinghouse Ninth Annual Machine Tool Forum

THE Machine Tool Electrification Forum sponsored by the Westinghouse Electric & Mfg. Co., which was held in May in Pittsburgh, Pa., was attended by 380 executives and engineers from machine tool plants throughout the country, in addition to a hundred or more engineers from the various works of the Westinghouse organization. This was the ninth annual meeting of this kind.

At the meeting, sessions were held morning and afternoon for two days. A great many papers were presented on problems of specific interest to machine tool engineers and designers. Obviously, electrical considerations predominated. Among the papers on electrical subjects should be mentioned: "New Ideas for Machine Tool Electrification," by G. A. Caldwell, of the Westinghouse organization; "Electrical Requirements of the Machine Tool Industry," by L. W. Scott Alter, president of the American Tool Works, Cincinnati, Ohio; "Control Assembly Factors," by E. E. Opel, electrical engineer of the National Automatic Tool Co., Richmond, Ind., and D. K. Frost, electrical engineer of the Mattison Machine Works, Rockford, Ill.; "Theory of the Mot-O-Trol," by W. I. Bendz, district engineer with the Westinghouse company; "Electrical Equipment for Automatic Tools," by G. B. Carson, research engineer of the Cleveland Automatic Machine Co., Cleveland, Ohio; and "Post-War Standards for Electrical Equipment of Machine Tools," by E. J. Rivoira, electrical engineer, Cincinnati Milling Machine Co., Cincinnati, Ohio, and R. H. Clark, electrical engineer, Warner & Swasey Co., Cleveland, Ohio.

Speed Ranges of Machine Tool Motors

In referring to new ideas for machine tool electrification, Mr. Caldwell dealt first with adjustable-speed drives for wide speed ranges. He mentioned how only two years ago, at that year's Forum, he had said that the electrical industry had not succeeded in producing an alternating-current motor that would operate over a wide speed range with satisfactory speed regulation; this is still true to the extent that a direct-current motor is used to obtain the speed ranges, although this motor, in turn, receives its power from an alternating-current circuit either through a motor-generator set or an electronic rectifier. At that time, the simplest form of such drive made possible a speed range for small machine tools of approximately 12 to 1. More elaborate drives, making use of rotating regulators called "Rototrols," made it possible to obtain speed ranges as high as 120 to 1.

At that time, the electronic drive known as the "Mot-O-Trol" was just being developed, but it had become obvious that it could be used to operate over speed ranges comparable to those obtained by the use of a motor-generator set with the "Rototrol." During the last two years, each of these drives has been applied to various machines and has proved that the wide range in speeds available results in a mechanical simplification of the machine and in greater production, due to more flexible operation. The "Mot-O-Trol" has proved especially popular, and is already considered standard equipment on several types of machine tools. It is likely that this type of drive will be the most widely used piece of electronic equipment in connection with machine tool operation.

Electronic Control for Generator Field Excitation

Another important application of electricity to machine tool operation is just being developed and is in about the same stage now as the Mot-O-Trol was two years ago. This is the use of electronic control for generator field excitation. In many regulating schemes, it has been found that, due to the fact that regeneration cannot be easily and economically obtained with the Mot-O-Trol, it is desirable to use a motor-generator set as a source of power. Electronic control is ideally suited for exciting the generator field to produce quick response and to provide effective anti-punting. In his paper, Mr. Caldwell gave specific examples of the application of this new development, referring specifically to milling machine operation.

Reference was also made to the Servo mechanism as applied to large lathes and boring mills. In this connection, speed ranges as great as 1000 to 1 have been made practicable by the development of Servo mechanisms.

The Development of the Mot-O-Trol

Mr. Bendz, in his paper on the Mot-O-Trol, described the principles involved in this type of drive and the advantages obtained through its use. The fact that it is seven years ago that the

Westinghouse organization began the development of an electronic adjustable-speed drive indicates the painstaking effort and the long continued experimentation that are often necessary in bringing engineering developments to the practical stage. In the "Mot-O-Trol," alternating current is converted into direct current through the use of Thyratron tubes without the use of a motor-generator set.

Materials, Surface Finishes, and Carbide Milling

Other addresses of an engineering character not dealing specifically with electrical subjects were also presented. Among these should be mentioned: "Research Developments in Materials," by Dr. A. A. Bates, manager Chemical and Metallurgical Department, Westinghouse Research Laboratories; "Cause and Control of Surface Damage," by E. L. Hemingway, chief metallurgist, Foster Division, International Detrola Corporation, Elkhart, Ind.; "Carbide Milling of Steel," by Dr. H. A. Frommelt, director of research, Kearney & Trecker Corporation, Milwaukee, Wis.; and "Expectations of a Machine Tool User," by E. L. Spray, manager Headquarters Mfg. Division, Westinghouse Electric & Mfg. Co.

In his paper on surface damage, Mr. Hemingway recorded the results of investigations made to determine the effect of finish on the tendency of surfaces to what is generally known as "galling." He explained this phenomenon as the welding together of minute spots of two surfaces that rub against each other. When such a weld forms, it is almost invariably broken instantly, with no perceptible slowing down in the movement of the surfaces, but a fragment of metal is torn from one surface and becomes a ragged projection on the other. It is these projecting sharp particles that cause more serious damage to bearing surfaces than any other common source of wear. Means for overcoming the difficulties created in this manner were discussed by the author, and a comparison was made between surfaces finished by various methods, like grinding and superfinishing.

Carbide Milling of Steel

Mr. Frommelt discussed the milling of steel with cemented-carbide tools in a concise manner, and quoted a number of specific examples of results that had been obtained in high-production milling. After touching briefly upon the history of carbide tools, he dealt concisely with coarse-pitch cutters, flywheel effect, relationship between spindle horsepower and depth of cut when using negative-rake milling cutters, relationship between spindle horsepower and feed, and between spindle horsepower and width of cut. The experiments also covered cutter life, showing the number of pieces milled with various cutter lead angles.

Some of the Post-War Problems Facing Industry

Colonel W. T. Chevalier, publisher of the *Business Week*, spoke on "Future Business Possibilities," and F. D. Newbury, vice-president of Westinghouse Electric & Mfg. Co., spoke on "Post-War Plans." Frederick S. Blackall, Jr., president of Taft-Peirce Mfg. Co., Woonsocket, R. I., gave an address covering the problems—present and post-war—facing industry in general and the machine tool industry in particular.

In dealing with post-war problems, Mr. Newbury pointed out that, in the last few years—especially in war production—there has been much less cost reduction from large-volume operations and large manufacturing lots than is generally assumed. In other words, the advantages gained from large-volume operation have been wiped out by other cost disadvantages, such as the cost of training new employes, the less effective supervision by the too rapid increase in employment, higher salary and wage rates, and heavy over-time and night-shift bonuses.

One significant fact is that the factory expense per hour of productive labor has gradually increased, instead of being reduced, as one would expect with the increase in volume.

Purchaser of Manufactured Goods is the Real Employer

With reference to post-war employment, Mr. Newbury said: "However much industry and the public generally may desire to avoid the sufferings and losses of extreme unemployment, full employment in the end will depend on the confidence of the public and of industry in the immediate future, and the consequent willingness on their part to spend their money. There will be plenty of money to spend, but the willingness and confidence to spend may be lacking."

He further pointed out that the Government can do a great deal to simplify post-war problems through a wise tax policy and through encouragement of business enterprise; and management and labor can help by cooperating in obtaining low production costs; but ultimately, it is the people at large who through their purchases provide their own employment.

Another of the post-war problems is the need for quick settlement of contract termination claims as soon as general cancellations begin. People at large understand very little of the importance to them of the quick settlement of these claims.

Attachment for Cutting a Keyway on a Milling Machine

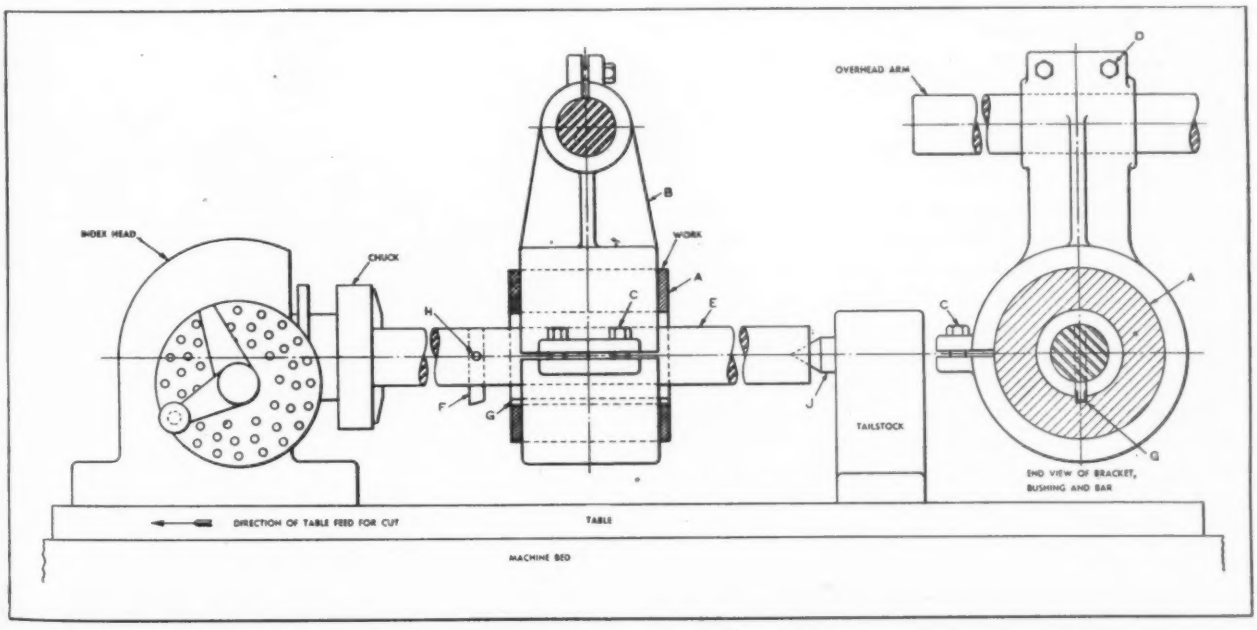
By HAROLD E. MURPHEY, Westerly, R. I.

The problem of cutting a keyway in a large bushing similar to that shown at *A* in the accompanying illustration came up in a plant where the writer was employed some time ago. As the work was too large for the keyseater and no broaching machines were available, a milling machine set-up employing the specially devised attachment illustrated was used, and very satisfactory results were obtained.

The attachment consists of bracket *B*, bored on one end to suit the bushing and split to permit clamping the bushing in place by means of two hexagonal-head cap-screws *C*. The opposite end was bored out to suit the overhead arm on the milling machine, and this was also split so that it could be clamped on the arm by means of two cap-screws *D*.

The cutter-bar *E* was made of cold-rolled steel, and carried a square tool bit *F* to suit the width of keyway to be cut at *G*. Pin *H* served to hold cutter *F* in place. One end of bar *E* was gripped in the chuck on the indexing head, while the opposite end was held by tailstock center *J*.

In setting up this attachment, the bracket was mounted on the arm of the milling machine and cap-screws *D* were tightened slightly. Bushing *A* was then placed in the opposite end and the cap-screws set up tight. A "Last Word" indicator was used at each end of the bushing to



Special Milling Machine Set-up Employed for Cutting Keyway at G in Bushing A

insure setting the bracket square with the table, and the binding cap-screws *C* were then set up tight. Bar *E* was next placed through the hole in the bushing and clamped in the chuck on the index-head. The tailstock was then brought into place to support the other end of the bar. In cutting the keyway, the table traveled in the direction shown in the illustration.

The table was set central with the hole in bushing *A*, and securely locked. Using the quick traverse for the return stroke of the tool and raising the table by means of the micrometer dial on the machine, it was possible to plane a keyway to the required depth. This set-up was arranged to cut one keyway only, but it can be easily adapted for cutting two or more keyways by proper indexing of the cutter-bar.

When a keyway is to be cut in the bottom of a bushing, as shown in the illustration, the table is raised to obtain the correct depth of cut.

When a keyway is to be cut at the top of a bushing, the bar *E* is indexed 180 degrees. The cutter is then fed into the work by lowering the table. In cases where the keyway is to be cut in the side of the bushing, or at the 90-degree position, the bar *E* is indexed 90 degrees, after which the cutter can be fed to depth by moving the table either in or out, depending on which side of the bushing the keyway is to be cut in.

Jig for Drilling Angular Holes in Small Parts

By KEN HIRST, Melbourne, Australia

The jig shown in the accompanying illustration is designed for drilling two angular holes *A* and *B* in a valve body. These holes are 0.1 inch in diameter and present a difficult drilling problem. First, damage to the threads at *D* and *E* must be avoided. This necessitates designing the jig so that even slight deflection of the drill is impossible.

The drill must pass the thread on one side of the inner edge and the other side of the outer edge. Also, in starting the hole, the drill will not cut at the center, but is forced to first come in contact with one of the side walls. This has a tendency to push the drill to one side, necessitating good support at this point.

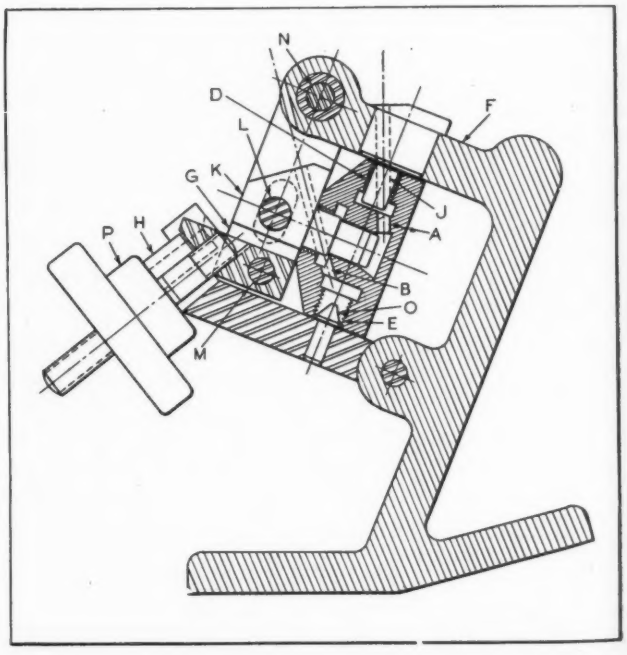
Since the outer surfaces of the work are not machined, the part must be located from the previously machined and threaded holes. The length of the work is only 1.3 inches, yet the holes are so located that unusually long drills must be employed.

The piece to be drilled is required in large quantities; hence, the use of an end-mill reamer was judged impractical. Also, the drilling of a part in two operations was considered to be too slow a method. Thus, a satisfactory solution of the drilling problem necessitated designing the jig in such a manner that the drills would be guided through the threaded portions of the work and be supported as near as possible to the point where the drill makes contact with the part.

The jig illustrated, which proved satisfactory, consists, primarily, of a cast-iron body *F*, equipped with a hinge member consisting of two parallel bars *G* and a hinge bar *H*. Hinge bar *H* carries a locating pin *O* and swivels about a pin in a boss on the upright member of body *F*. Drill bushing *J* is fixed in the cast-iron body *F* of the jig, while drill bushing *K* is fastened between hinge bars *G* in such a manner that it can slide freely between them and swivel at the same time about fulcrum pin *L*.

To insure accurate alignment of this bushing, the two bars are accurately spaced by the bridge around pin *M* and the sleeve surrounding pin *N*. This sleeve serves also as a pivot for the two hinge bars *G*. The screw employed to lock the hinge bars and thus clamp the work securely in place is fastened in the bridge around pin *M*. This locking screw slides in a slot in hinge *H* that carries pin *O*, which serves as a third location point for the work. Both of the drill bushings are designed to provide maximum support for the drills while passing through the threaded holes.

In loading, the jig is inverted so that it rests on the two bosses at the top of the body in such a manner that bushing *J* is in a vertical position. The work is then placed in the jig with the threaded hole *D* over the projecting end of drill



Jig for Drilling Angular Holes A and B

bushing *J*. The hinge bars *G* are then lifted and bushing *K* is guided into the central hole in the piece. The closing of hinge *H* brings the guide pin *O* into the third hole in the part.

Finally, the jig is locked by tightening handwheel *P*. The jig is then turned around so that it rests on one of the two bases for drilling the first hole. After completing the first drilling operation, the jig is tilted up so that it rests on the other base for drilling the second hole. The work is unclamped by loosening handwheel *F* and opening hinge *H* and hinge bars *G*.

Lathe Arbor Designed to Insure Concentricity

By EDWARD LAY, Chief Tool Designer
Fairchild Aviation Corporation

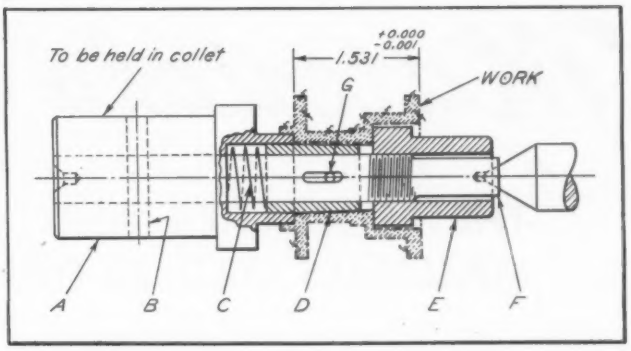
A lathe arbor for use in machining the outside diameter of a hub-shaped aluminum piece concentric with the inside diameter, and at the same time maintaining close limits on the dimension from the inside shoulder to the outer base surface, is shown in the accompanying illustration. Die-cast parts of this kind for use in instruments frequently require closer finished dimensions than can be maintained on commercial die-castings.

The aluminum piece was originally made from bar aluminum stock on an automatic, but for certain reasons, this practice was discontinued and die-castings were used instead. The outside diameter was required to be finished, and plans were made to employ the circular forming tool previously used on the automatic, mounting it on the rear toolpost on the cross-slide of a No. 3 W & S machine.

This method required an arbor designed to fulfill two requirements—first, to hold the work-piece concentric, and second, to secure and clamp each successive piece of work in the same location, regardless of variations in the cored hole diameter, in order to finish-machine the piece all over without requiring resetting of the form tool for each piece. This was accomplished by using the arbor shown in the illustration.

The arbor consists essentially of seven parts, which include the shank *A;* stem *F*, which is a light press fit in *A*, and is prevented from twisting by a cross-pin *B;* spring *C*, which is designed to exert a 22-pound pressure; flange nut *E;* pin *G;* and sleeve *D*, which is the part of unusual interest. The outside diameter of this sleeve is slightly tapered to suit the draft in the die-cast cored hole. The pin *G* in the slot serves to retain the sleeve and prevent it from twisting when the work-piece is run off the arbor after the machining operation is completed.

Loading of the arbor can be readily accomplished on the lathe. The 22-pound spring pressure is sufficient to allow the casting to be pushed on the sleeve and properly seated. The nut *E*, with two-thirds of the threads removed in order to save loading time, forces the work with the sleeve toward the nose on shank *A*, thus bringing the work into correct alignment with reference to the forming tool.



Lathe Arbor Designed to Insure Accurate Machining of Die-cast Aluminum Part

For efficient, clean cutting action, a tailstock center was employed, as shown. The cross-slide with the forming tool is fed inward until it comes in contact with a stop, which is adjusted to insure machining the work to the required diameters.

* * *

Machine Tool Orders Increase

The machine tool shipments in March, the last month for which complete statistics are available, according to figures issued by the Tools Division of the War Production Board, were valued at $50,800,000. The net new orders placed for machine tools during March—that is, total orders less cancellations—amounted to slightly more than $40,000,000, or at an annual rate of $480,000,000. This is considerably more than twice the largest peacetime volume, and is the largest amount of net new orders placed for machine tools for several months. The backlog of unfilled orders at the end of March was valued at $155,000,000, or approximately three months' production at the present rate of shipments.

* * *

Any "statesman" who imagines that governmental policies which make property insecure or which discourage its acquisition and employment in private enterprise can make society prosperous is an economic moron. Tax policy and every economic policy should favor the man who invests in a new or expanded business.—*Stevenson, Jordan & Harrison, Inc.*

Materials of Industry

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

New Type Wire Solder with Flux on the Outside

A new type fluxed wire solder, called "Fluxrite," that contains flux in longitudinal grooves on the surface of the wire rather than in the conventional core, has been introduced on the market by the National Lead Co., 111 Broadway, New York 6, N. Y. This solder is said to overcome the inherent disadvantage of regular cored solders which supply flux and solder to the working surface simultaneously. Since the flux in the new solder is outside rather than inside, it liquefies and flows on the work before the solder melts. This insures thorough and complete fluxing, and results in stronger and better joints. 201

"Polythene" Plastic—A Recent du Pont Development

A new plastic—Polythene—manufactured by the polymerization of ethylene, has been announced by E. I. du Pont de Nemours & Co., Wilmington, Del. The outstanding properties of Polythene include flexibility and toughness over a wide range of temperatures; unusually good resistance to water and to penetration by moisture; chemical inertness; and excellent electrical characteristics. This new plastic, now restricted to war use, is expected to be utilized, when available, for various types of containers, including collapsible tubes for food and cosmetics, gaskets and battery parts, flexible tubing or more rigid piping, waterproof and chemically resistant coatings, and adhesives. 202

Anodic Corrosion-Resistant Coating for Zinc

A corrosion-resistant coating for zinc-plated surfaces, and in some cases, for zinc-base diecastings, is obtained by an anodic process known as "Anozinc," developed by United Chromium, Inc., 51 E. 42nd St., New York 17, N. Y. Parts finished by this process and subjected to the Army-Navy salt-spray test (Spec. AN-QQ-S-91) have stood up more than two hundred hours. They have also withstood considerable abuse and flexing without flaking.

Two finishes are available—a black and a brassy, slightly iridescent yellow. A different bath is used for each color. The process is carried on at room temperature in an unlined steel tank. Steel cathodes are used, and the work is made anodic at 6 volts or less. At a current density of 20 amperes per square foot, about 3 minutes is required to produce the finish...203

Iron Cement for Repairing Metal Parts

A new iron cement known as "Fix-Iron" has been developed by the So-Lo Works, Loveland, Ohio, for repairing broken, cracked, or defective metal castings and piping; making joints, seams, and loose parts secure; and stopping leaks in boilers, furnaces, fire-pots, and other metal equipment. The product is in powder form, and after being mixed with water, is applied without heat. It may be hammered into cracks or other openings, and after hardening, it has the same expansion and contraction with temperature changes as the iron. 204

Micronoil Treatment for Protecting Gages, Dies, and Other Tools

A treatment for gage faces and other surfaces used for precise measurement which are subject to wear has been developed by Protective Coatings, Inc., Box 56, Strathmoor Station, Detroit 27, Mich. The treatment consists of a liquid known as "Micronoil," which is applied either by dipping or brushing. In the case of gages, it is applied particularly to the leading edge from time to time, as determined by usage. This treatment, also suitable for precision dies, taps, punches and reamers, greatly increases the wear resistance of the surface or edge so treated, and thus helps to maintain the original accuracy over extended periods. 205

To obtain additional information on materials described on this page, see lower part of page 192.

Gear Manufacturers' Annual Meeting

THE twenty-eighth annual meeting of the American Gear Manufacturers Association, held at the Westchester Country Club, Rye, N. Y., May 22 to 24, was characterized, as usual, by a very large attendance of the executives and engineers in the gear industry and by a program that gave thorough attention to both the business and the engineering problems confronting the industry. The standardization activities of the Association, which have always been one of its main concerns, were given due prominence, and, in addition, a number of outstanding papers relating to the design of gears and research in gearing were presented.

The meeting was opened by the president of the Association, Russell C. Ball, president of the Philadelphia Gear Works, Inc., Philadelphia, Pa. In his address, Mr. Ball briefly touched upon some of the important problems confronting industry in general and the gear industry in particular.

Among the outstanding engineering papers presented was one on "Aircraft Gearing," by John O. Almen, of the Research Division of the General Motors Corporation. This paper was a thoroughgoing treatise on the subject.

"Combined Static Stresses in Teeth of Spur Gears—a New Approach" was the title of a paper presented by M. Maletz, analytical mechanical engineer of the Kearney & Trecker Corporation, Milwaukee, Wis. In his paper, Mr. Maletz reviewed the various formulas and modifications of formulas that have been developed for calculating the stresses in gear teeth, including the formulas by Lewis, Wissman, Merritt, and Heldt, analyzing each of these, in turn, and outlining in detail a suggested formula developed to take care of certain factors not completely covered in previous formulas.

Another comprehensive paper was presented by H. W. Kayser, development engineer of the Falk Corporation, Milwaukee, Wis., on "Sleeve Bearings." In this paper, the author covered many phases of the subject, and brought together much information that will prove of value and interest to the designing engineer.

The problems of post-war industry were ably and exhaustively dealt with by F. D. Newbury, vice-president of the Westinghouse Electric & Mfg. Co. In his address "Reconversion to Post-War," Mr. Newbury called attention to many of the important problems that industry faces in changing back from war production to peacetime efforts. He particularly emphasized the importance of the efficient handling of the termination of Government contracts and of prompt settlements of the financial obligations of the Government, so that industry will find itself able to meet the reconversion problems with sufficient working capital to provide early and adequate employment in the reconverted peacetime industries.

The Machine Tool Distributors Discuss Many Industry Problems

AT the twentieth spring meeting of the American Machine Tool Distributors' Association, held at French Lick Springs Hotel, French Lick, Ind., May 25 and 26, a great many papers were presented dealing both with the distribution side of the machine tool industry and with mechanical problems. Tell Berna, general manager of the National Machine Tool Builders' Association, spoke on "Machine Tools from War to Peace." John S. Chafee, director of the Tools Division, War Production Board, Washington, D. C., presented a paper on "Present Machine Tool Problems from the Tools Division Angle." An engineering paper highly informative in character was presented by H. A. Frommelt of the Kearney & Trecker Corporation, Milwaukee, Wis., on the subject "Carbide Milling of Steel."

The importance of electrical developments in machine tool applications was evidenced by the two papers on electronics presented before the convention. One of these, by W. R. King of the General Electric Co., Schenectady, N. Y., covered "The Advance of Electronics in the Machine Tool Field"; the other, by S. D. Fendley, also of the General Electric Co., dealt with "Electronic Adjustable-Speed Drives."

Two sessions were devoted to reports by the various committees of the Association, including an address by A. G. Bryant, president of Bryant Machinery & Engineering Co., Chicago, Ill., entitled "Report on Washington Developments."

At a dinner meeting, Major General L. H. Campbell, Jr., Chief of Ordnance, War Department, spoke on "Ordnance Machine Tools are Helping to Bring Victory."

New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 191 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the June Number of MACHINERY

Milling, Broaching, and Grinding Machines

CINCINNATI MILLING MACHINE CO. and CINCINNATI GRINDERS INCORPORATED, Cincinnati 9, Ohio, are distributing a bi-monthly publication entitled "Report from Cincinnati Milling," which describes interesting operations and equipment relating to milling, cutter sharpening, broaching, grinding, lapping, profiling, and die-sinking. 1

Welding Supplies and Accessories

AIR REDUCTION SALES CO., 60 E. 42nd St., New York 17, N. Y. Revised price list covering gas and electric welding supplies and accessories. In addition to prices, the contents include information of aid to buyers, such as sizes, dimensions, weights, recommended uses, etc. 2

Engineering and Designing Services

ATLAS METAL STAMPING CO. and ATLAS TOOL & DESIGNING CO., Castor and Kensington Aves., Philadelphia 24, Pa. Catalogue outlining the engineering and designing services offered by this company, including product designing, tooling, and the building of special machinery. 3

Resistance Welding Equipment

GENERAL ELECTRIC CO., Schenectady 5, N. Y. Bulletin GET-1189, containing information on resistance welding methods and equipment, including the selection of equipment; electrodes and their maintenance; and material and its preparation for welding. 4

Automatic Temperature Controls

LEEDS & NORTHRUP CO., 4921 Stenton Ave., Philadelphia 44, Pa. Catalogue N-33B, describing the application of Micromax and Speedomax Rayotube pyrometers for measuring and controlling temperatures. Specifications on various models are included. 5

Industrial X-Ray Equipment

NORTH AMERICAN PHILIPS CO., INC., 100 E. 42nd St., New York 17, N. Y. Folder S150, descriptive of Norelco Searchray 150, a self-contained industrial X-ray unit that provides a quick means for making non-destructive examinations of specimens for internal flaws, cracks or foreign matter. 6

Tap Handbook

THREADWELL TAP & DIE CO., Greenfield, Mass. Handbook containing a fund of useful information on the selection, use, and care of taps, intended to serve as a practical guide for the workman who wants to get the best possible results with a tap. 7

Surface Roughness Measurement

PHYSICISTS RESEARCH CO., 343 S. Main St., Ann Arbor, Mich. Booklet entitled "Practical Surface Roughness Measurement," containing information on the use of Profilometer roughness gaging equipment. 8

Precision Tools

MCGRATH ST. PAUL CO., 5th and Wacouta Sts., St. Paul 1, Minn. Catalogue covering the line of precision tools made by this concern, including steel rules, calipers and micrometers, height and thickness gages, thread gages, optical flats, etc. 9

Stainless Steel Identification Chart

CARPENTER STEEL CO., 105 W. Bern St., Reading, Pa. Chart for identifying various types of stainless steels that may have become mixed in stock. The chart gives eleven tests for separating the various types. 10

Collets and Collet Index Fixtures

HARDINGE BROTHERS, INC., Elmira, N. Y. Bulletin illustrating and describing the Hardinge Style S "Sure-Grip" master collets and pads. Circular descriptive of horizontal-vertical collet index fixtures with threaded nose spindle. 11

Precision Gaging Instruments

CONTINENTAL MACHINES, INC., 1301 Washington Ave. S., Minneapolis 4, Minn. Booklet entitled "How to Measure in Micro-Inches," showing many applications of DoAll precision measuring instruments, including gage-blocks, master parallels, flats, etc. 12

Portable Electric Drills with Plastic Housings

INDEPENDENT PNEUMATIC TOOL CO., 600 W. Jackson Blvd., Chicago 6, Ill. Booklet describing the features of the new Thor plastic-housed portable electric drill. Limited number of copies available to production executives. 13

Meehanite Castings

MEEHANITE RESEARCH INSTITUTE OF AMERICA, Pershing Square Bldg.,

New Rochelle, N. Y. Bulletin 18, entitled "Meehanite—The Metal for Post-War Castings," describing a variety of recent applications of Meehanite castings for highly stressed parts. 14

Stellite Cutting Tools

HAYNES STELLITE CO., Kokomo, Ind. Circular 2991, on Stellite Star J-Metal cutting tools, giving sizes, prices, speeds and feeds for turning, facing, and boring, recommended wheels for grinding these tools, and other data. 15

Steelweld Presses

CLEVELAND CRANE & ENGINEERING CO., 1157 E. 283rd St., Wickliffe, Ohio. Catalogue 2010-A, on Cleveland Steelweld bending presses and bulldozers, showing various applications and giving dimensions of the different sizes. 16

Carbide-Tipped Tools

WENDT-SONIS CO., Hannibal, Mo. Catalogue 144, listing standard carbide-tipped cutting tools and giving data for selecting the correct tool for machining various materials. 17

Constant-Level Oilers

TRICO FUSE MFG. CO., 2948 N. 5th St., Milwaukee 12, Wis. Bulletins 24-A and 25-A, describing an automatically controlled visible oiling method for ring or ball bearings, shafts, gear and pump housings, etc. 18

Abrasive Cutting Machines

ANDREW C. CAMPBELL DIVISION, AMERICAN CHAIN & CABLE CO., INC., Bridgeport, Conn. "Abrasive Cutting Tip Sheet," containing information on abrasive cutting machines, and answers to questions on abrasive cutting problems. 19

Preventing Contamination of Cutting Solutions

OAKITE PRODUCTS, INC., 26 Thames St., New York 6, N. Y. Field Service Report on "Combating Bacteria Growth in Oil-Water Cutting Solutions." 20

Carbide Tools

CARBOLOY COMPANY, INC., 11147 E. Eight Mile Ave., Detroit 32, Mich. General tool catalogue GT-175, containing 30 pages of data on carbide standard tools, "semi-standard" tools, and form tools. ..21

Lubrication

SUN OIL CO., 1608 Walnut St., Philadelphia 3, Pa. Booklet entitled "How to Get the Most Out of Lubricants"—one of a series of booklets in a "Save and Serve with Proper Lubrication" campaign. ..22

Electrodes for Tool and Die Welding

C. E. PHILLIPS & CO., 2750 Poplar St., Detroit 8, Mich. Bulletin containing data on selection of correct electrode, welding procedures, and heat-treatment for tool and die steels. 23

Molybdenum-Tungsten Steels

CLEVELAND TWIST DRILL CO., 1242 E. 49th St., Cleveland, Ohio. Fourth edition of a treatise on Mo-Max molybdenum-tungsten high-speed steels and applications. 24

Electronic Controllers

BRISTOL CO., Waterbury 91, Conn. Bulletin B220, describing the company's new line of free-vane electronic controllers for automatically controlling temperature, pressure, liquid level, and humidity. 25

Compressors and Vacuum Pumps

INGERSOLL-RAND CO., 11 Broadway, New York 4, N. Y. 32-page catalogue on compressors and vacuum pumps ranging in sizes from 1/2 to 10 H.P. 26

Spring Washers

NATIONAL LOCK WASHER CO., Newark, N. J. Bulletin on Kantlink steel spring washers. Also chart giving recommended sizes of spring washers for use with different types and sizes of screws. 27

Machine Auxiliary Equipment

READY TOOL CO., 550 Iranistan Ave., Bridgeport, Conn. Catalogue 44, containing data on ball-bearing centers, high-speed centers, toolholders, dogs, and boring-bars. ..28

Rotary Shears

KLING BROS. ENGINEERING WKS., 1308 N. Kostner Ave., Chicago 51,

To Obtain Copies of New Trade Literature

listed on pages 190-192 (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail within three months of the date of this issue to:

MACHINERY, 148 Lafayette St., New York 13, N. Y.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Name.....*Position or Title*.....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

Firm.....

Business Address.....

City.....*State*.....

[SEE OTHER SIDE]

Ill. Bulletin 245, illustrating and describing Kling rotary shears for cutting straight lines, bevels, curves, or odd shapes. 29

Structural-Aluminum Welder

PROGRESSIVE WELDER CO., 3050 E. Outer Drive, Detroit 12, Mich. Bulletin 103, describing the company's new rocker-arm welder, designed for rapidly spot-welding structural aluminum sections. 30

Reversible Ratchet Wrenches

GREENE, TWEED & CO., Bronx Blvd. at 238th St., New York 66, N. Y. Bulletin F-10, illustrating and describing "Favorite" double-head ratchet wrenches. 31

Surface Finish Control

GEORGE SCHERR CO., INC., 400 Broome St., New York 12, N. Y. Circular on the Spencer binocular microscope used for the inspection and control of surface finish. 32

Retainer Rings

EATON MFG. CO., RELIANCE SPRING WASHER DIVISION, Massillon, Ohio. Folder 43, containing engineering data on Reliance snap, lock, and retainer rings. 33

Thermo-Couple Data

WHEELCO INSTRUMENTS CO., Harrison and Peoria Sts., Chicago 7, Ill. Bulletin S2-4, entitled "Wheelco Thermo-Couple Data Book and Catalogue." 34

Carbide-Tipped Gages

METAL CARBIDES CORPORATION, Youngstown 5, Ohio. Catalogue PG-44, containing prices and specifications covering standard Talide-tipped plug and ring gages. 35

Electric Transformers

GENERAL ELECTRIC CO., Schenectady 5, N. Y. Bulletin GEA-4193, entitled "Summary of Safety and Savings with All-Purpose Pyranol Transformers." 36

Light-Duty Tapping Machines

DETROIT TAP & TOOL CO., 8432 Butler St., Detroit 11, Mich. Bulletin LTM-44, describing this company's improved light-duty tapping machine. 37

Coil Springs

MUEHLHAUSEN SPRING CORPORATION, 1943 Michigan Ave., Logansport, Ind. Folder describing in sequence the steps taken in manufacturing large hot-coiled springs. 38

Calliflex Bi-Metals

CALLITE TUNGSTEN CORPORATION, 540 Thirty-ninth St., Union City, N. J. Bulletin 155, containing technical data on Calliflex thermostatic bi-metals. 39

Aluminum Screw Products

ALUMINUM COMPANY OF AMERICA, Pittsburgh, Pa. Catalogue AD-111, on Alcoa aluminum screws, bolts, nuts, etc. 40

Carbide Tools

SUPER TOOL CO., 21650 Hoover Road, Detroit 13, Mich. Bulletin entitled "Super Carbide Tipped Shell End and Face Mills." 41

Industrial Vacuum Cleaners

SPENCER TURBINE CO., Hartford 6, Conn. Bulletin showing various industrial applications of Spencer vacuum cleaning equipment. 42

Injection Molding Machines

WATSON-STILLMAN CO., Roselle, N. J. Bulletins 621-A and 622-A, describing horizontal and vertical injection molding machines. 43

Tensile Testing Instruments

W. C. DILLON & CO., INC., 5410 W. Harrison St., Chicago 44, Ill. Bulletin 141, descriptive of the new Dillon Model K tensile tester. 44

Safety Clutches

FLATON MACHINE WORKS, 7829 S. Broadway, St. Louis 11, Mo. Folder descriptive of Flaton automatic safety clutches. 45

Thermo-Electric Glue Heater

DIVINE BROTHERS CO., Utica, N. Y. Leaflet on the Divine thermo-electric glue heater. 46

Hot-Work Steels

JESSOP STEEL CO., Washington, Pa. Bulletin 643, on Jessop J and JJ hot-work steels. 47

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 193-222 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in June, 1944, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on other side of this blank.

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on page 188, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning name of material as described in June, 1944, MACHINERY.

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Detach and mail to MACHINERY, 148 Lafayette St., New York 13, N. Y.

[SEE OTHER SIDE]

Shop Equipment News

Fig. 1. Barnes Special Hydraulic Forming Press

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Barnes Special Hydraulic Forming and Drawing Machines

The horizontal forming press and the cold-drawing machine illustrated in Figs. 1 and 2, respectively, are typical examples of hydraulically operated special equipment built recently by the John S. Barnes Corporation, 301 S. Water St., Rockford, Ill. The small forming press, shown in Fig. 1, was built to the exact specifications of a customer. An outstanding feature of this machine is the safety control, which consists of two push-button stations.

These dual control stations must be operated simultaneously, one by the right hand and the other by the left hand. The stations are mounted centrally on the face of the machine and spaced 24 inches apart. They positively control the advance and return motions of the ram. The ram can be advanced toward the die-holder only when the two buttons marked "forward" are depressed. Likewise, the reverse motion of the ram is obtained only when both buttons marked "return" are depressed simultaneously. With this arrangement, accidents to the hands are completely eliminated, even when unskilled operators are employed.

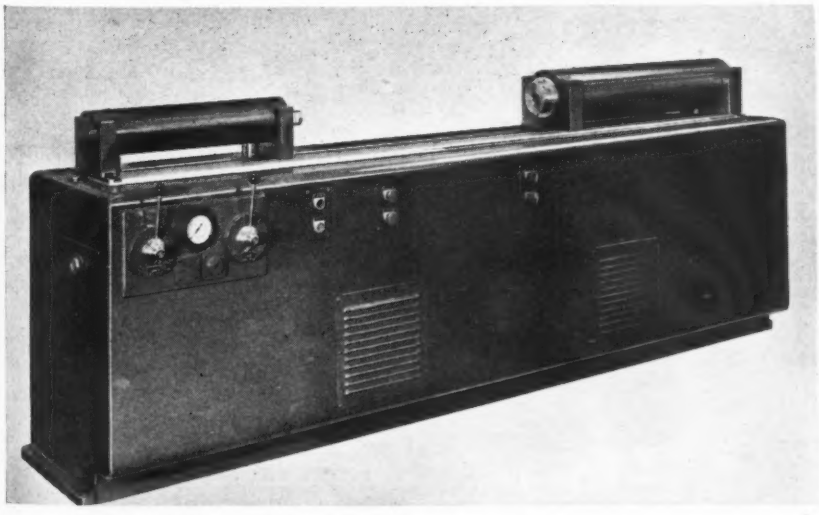


Fig. 2. Barnes Hydraulically Operated Drawing Machine

The ram is advanced smoothly at the rate of 45 inches per minute, and returned at a speed of 90 inches per minute by the hydraulic system, which develops a maximum pressure of 800 pounds per square inch during the forward stroke, with a minimum expenditure of energy. The table is readily accessible, free from unnecessary obstructions, and located at a convenient working height. A flange-mounted dial gage on the front of the machine indicates the pressure exerted by the forming ram.

The compact hydraulic unit in the left-hand end of the machine is accessible by removing a sheet-metal cover at the rear of the base. The electrical control panel, including the transformer and disconnect switch, is located on the right-hand end of the base, and can be easily

To obtain additional information on equipment described on this page, see lower part of page 192.

reached by simply removing a cover plate.

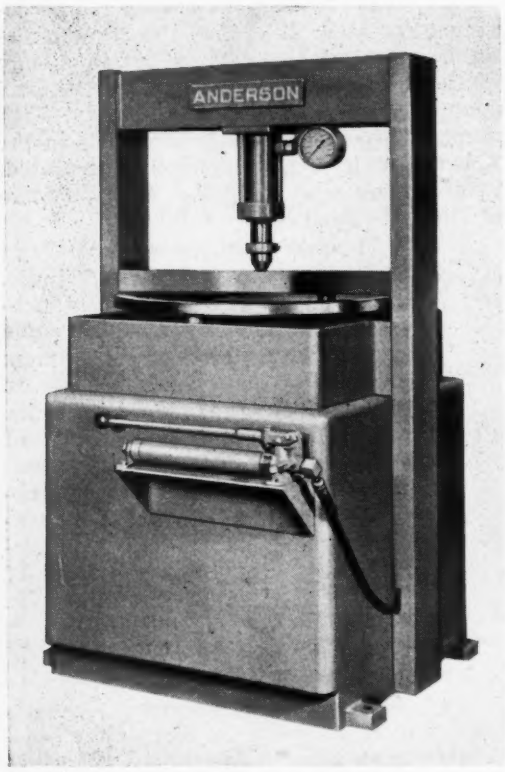
The 7 1/2-ton hydraulic drawing machine, shown in Fig. 2, was developed in accordance with specifications of a customer to meet the requirements of a specific machining operation. The drawing die, mounted centrally on the working table, supports the work. When the work is set up, the machine cycle is started by depressing the two "forward" push-buttons simultaneously. The small ram at the left then advances and stops just in back of the die. Next, the large ram moves forward, forcing the work through the die, the drawn piece being steadied by the small ram. As the large ram moves forward, it exerts a differential load of 5 tons upon the work. When the drawing operation is completed, the "return" push-buttons are depressed, causing the large ram to return to the starting position.

The dial pressure gage on the left front face of the machine indicates the load on the die throughout the drawing cycle. The two adjacent control handles operate speed control valves, which permit variable traverse rates up to 240 inches per minute. The hydraulic unit is mounted in the left-hand end of the machine base, and the electrical control panel is located at the opposite end of the base. All equipment is readily accessible by removing sheet-metal covers. 51

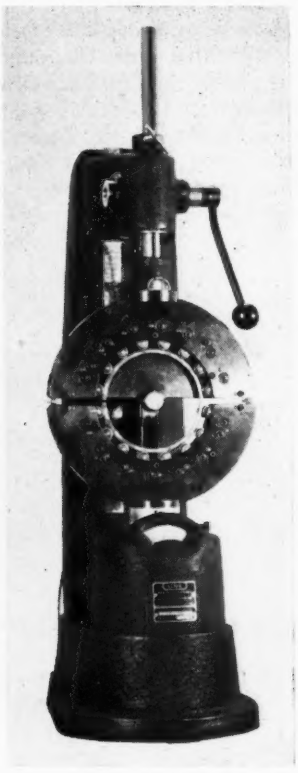
Anderson Hydraulic Straightening Press

A hydraulic press with a 30-inch square table for straightening large gear blanks and metal rings is being introduced on the market by Anderson Bros. Mfg. Co., 1907 Kishwaukee St., Rockford, Ill. The table of this press is accurately machined, and can be used as a checking plate. The press has a capacity of 20 tons, and is operated by a hand-actuated hydraulic pump. Similar presses in capacities from 10 to 50 tons, with either hand or power control, are available.

A hydraulic gage, calibrated in pounds to indicate the actual pressure on the ram, is positioned in line with the operator's eyes for easy reading. The streamline design facilitates cleaning and provides ample foot room for the operator. The ram has a stroke of 5 inches. The maximum vertical opening is 8 inches. The press requires a floor space of 40 by 40 inches, and weighs 1500 pounds. 52



Hydraulic Straightening Press Built by Anderson Bros. Mfg. Co.



Link Radial-wall Pressure Tester for Piston-rings

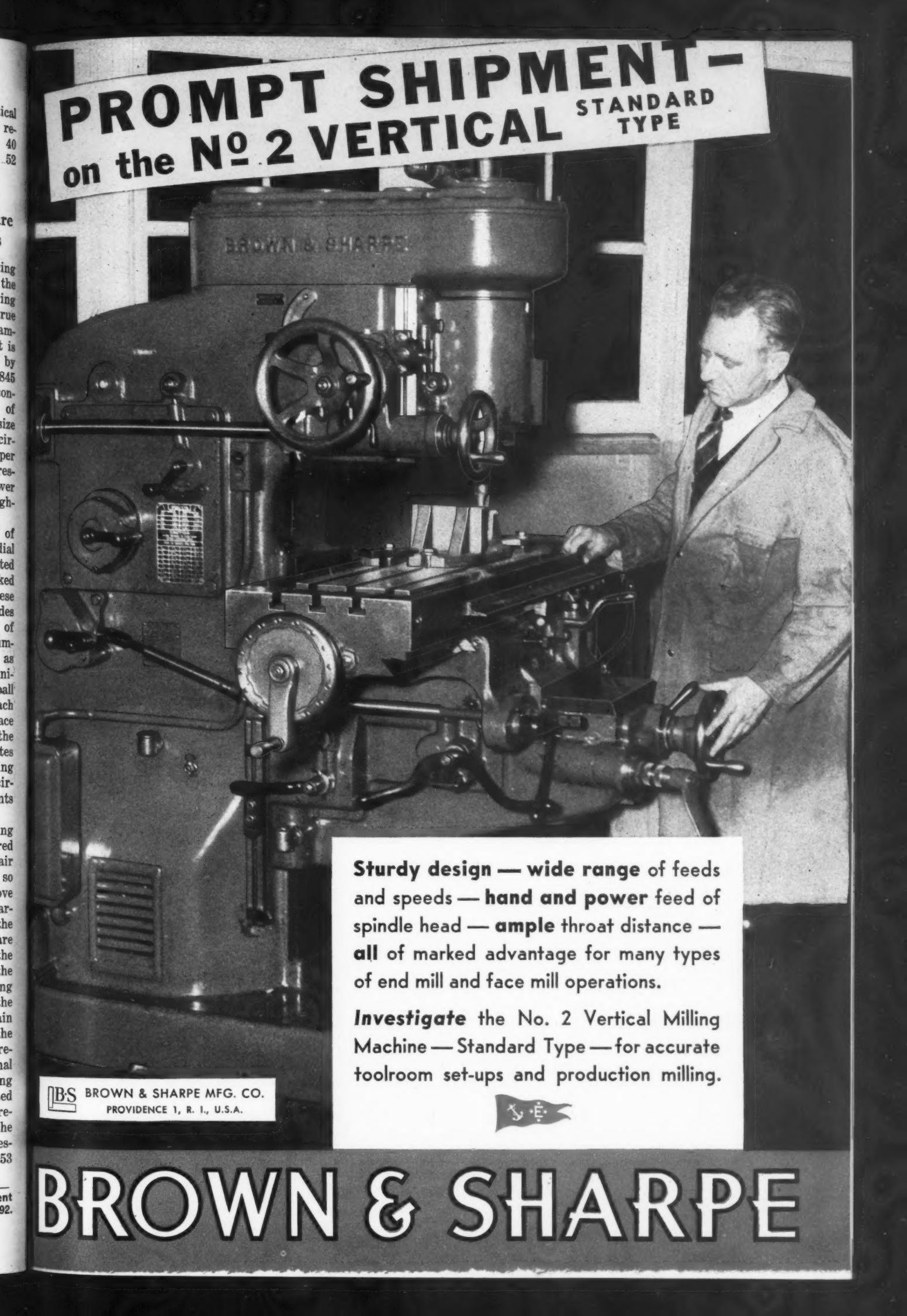
Link Radial-Wall Pressure Tester for Piston-Rings

A PC4 roller type piston-ring tester, designed to determine the pressure exerted by a piston-ring when it is compressed to a true circle conforming to the bore diameter of the cylinder in which it is to be used, has been developed by the Link Engineering Co., 13845 Elmira Ave., Detroit, Mich. It consists of a Link tester, usually of 50 pounds capacity for average-size rings, to which a pair of semicircular yokes are fitted. The upper half-yoke is fitted to the compression head assembly, and the lower half-yoke is mounted on the weighing table of the tester.

In each half-yoke is a series of uniformly spaced internal radial channels in which are closely fitted adjustable slides which are backed up by compression springs. These springs tend to push the slides toward the center. The number of slides varies with the circumference of the ring to be tested, as required to compress the ring uniformly. The outer race of a ball bearing at the inner end of each slide comes in contact with the face of the ring to be tested when the tester is in use. This eliminates sliding friction as the piston-ring is being compressed to a true circular form, and it also prevents marring the face of the ring.

The tester is set for use by placing a master ring gage of the desired diameter in the center of the pair of yokes and releasing the slides, so that the springs cause them to move radially inward until the ball-bearing races come in contact with the master ring gage. The slides are then locked, the outer races of the ball bearings being arranged in the form of a true circle. When a ring to be tested is placed between the two yokes and the yokes again brought to the specified point, the ring will be compressed to the required size. A preset electric signal provides a means of determining just when the ring is compressed to a true circular shape of the required diameter. At this point, the load dial is read to obtain the pressure exerted by the ring. 53

To obtain additional information on equipment described on this page, see lower part of page 192.


PROMPT SHIPMENT—
on the No. 2 VERTICAL STANDARD TYPE
BROWN & SHARPE
Sturdy design — wide range of feeds and speeds — hand and power feed of spindle head — ample throat distance — all of marked advantage for many types of end mill and face mill operations.
Investigate the No. 2 Vertical Milling Machine — Standard Type — for accurate toolroom set-ups and production milling.
B·S BROWN & SHARPE MFG. CO.
PROVIDENCE 1, R. I., U.S.A.
BROWN & SHARPE

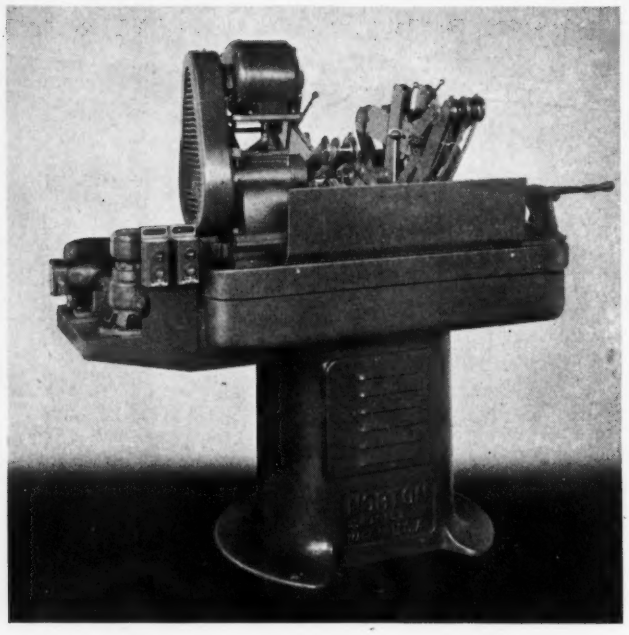
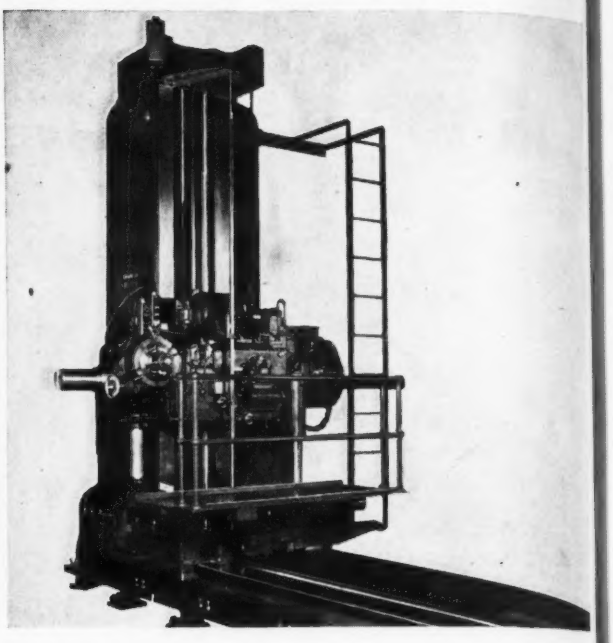


Fig. 1. Norton Simplex Lapping Machine



Gilbert Horizontal Drilling and Boring Machine

Norton Simplex Lapping Machine

A comparatively simple lapping machine incorporating many of the features of the Norton Crank-O-Lap has been brought out by the Norton Co., Worcester 6, Mass. This new machine is designed to perform simultaneous finishing operations on several cylindrical surfaces. It is adapted for use on such machine parts as are found in radial aircraft engines and their accessories or similar parts having cylindrical sections between shoulders or having adjacent gears or overhanging flanges.

Surface finishes as low as 1 micro-inch (r.m.s.) are obtainable in a single operation. One bearing or several bearings on a piece can be finished in less than a minute. This machine is especially designed for versatility and quick change-over from one job to another. It will also lap concentric or eccentric cylindrical surfaces at the same time, as well as such sections as the short-throw cranks on compressors and the journals and eccentric members of small camshafts. It has a capacity for finishing work from 1/2 inch to 2 inches in diameter in lengths up to 24 inches, using abrasive-coated paper strips. 54

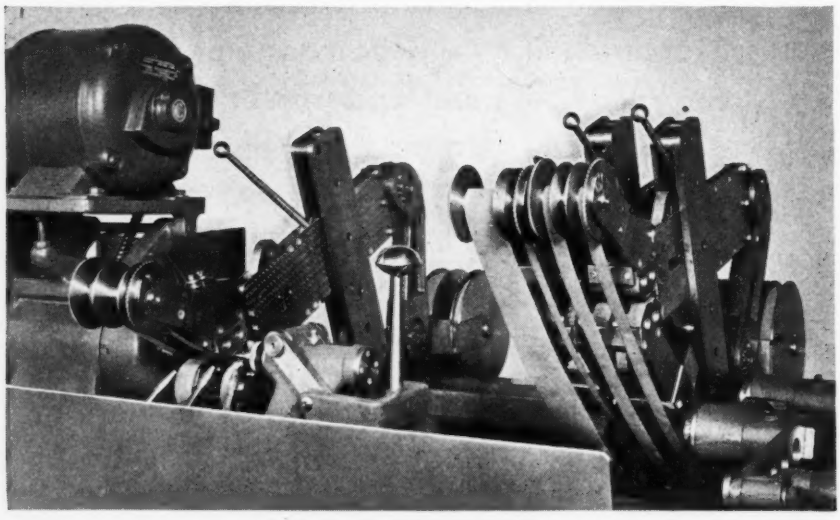


Fig. 2. Close-up View of Lapping Equipment of Machine Shown in Fig. 1

Gilbert Drilling and Boring Machine

A heavy-duty, horizontal boring, drilling, and milling machine is being placed on the market by the Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio, which has a self-contained unit type head that can be mounted on various existing floor type columns, such as those of the P & H and the Ryerson Nos. 11 and 12 horizontal drilling machines. The fully enclosed head unit contains the built-in, reversible drive motor, the lubricating system, and all gearing, shafting, and bearings for obtaining the spindle speeds, drilling feeds, milling feeds, and rapid traverse. The quill type spindle of this machine is adapted for driving multiple drilling heads.

Lubrication of the head is furnished by a self-priming, positively driven pump, which operates only when the driving motor is running. The oil is raised from a sump in the bottom of the head, passed through an oil filter, and distributed through pipes to all bearings and gears.

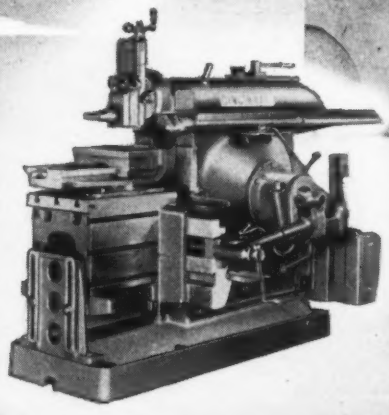
The centralized controls provide for electrically starting, stopping, and reversing the spindle; changing spindle speeds and feeds; selecting power rapid traverse or power feeds; reversing all feeds and engaging the rapid traverse movements; obtaining fine hand feeds for the spindle head and col-

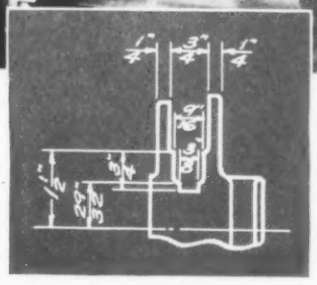
To obtain additional information on equipment described on this page, see lower part of page 192.

Production

A surprising number of Cincinnati Shapers are on production jobs—they have stepped out of the tool room into the manufacturing shop... Here is a typical example of a Heavy Duty Cincinnati Shaper, using a simple fixture and forming tool, producing with economy and efficiency... There may be a spot in your shop where a Heavy Duty Cincinnati Shaper can be used with profit.

Write for our complete Catalog No. N-2.





THE CINCINNATI SHAPER CO.

CINCINNATI OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

umn, using dials reading to 0.001 inch; clamping head to column; clamping spindle; and clamping column to runway.

The minimum distance from center of spindle to top of runway is 25 inches. The runway is 45 inches wide and 14 inches high. The machine is available in sizes having a vertical travel of the spindle head of 60, 72, 84, and 96 inches, and a horizontal travel of the column of 60, 72, 84, 96, 120, 144, and 168 inches. A 7 1/2- or 10-H.P., 1800 or 1500 R.P.M., reversible motor mounted on the head drives directly through spur gearing to the initial drive-shaft. 55

LeBlond Hexagonal Turret for Regal Lathes

The R. K. LeBlond Machine Tool Co., Cincinnati 8, Ohio, is now supplying 13- and 15-inch Regal lathes with a hexagonal ram type bed turret which is interchangeable with the regular tailstock. This turret is available with power feed or hand feed. It is supported by double, preloaded roller bearings, which are automatically lubricated and adjustable for clearance.

The six-station turret measures 9 inches across the faces. Each face is 3 1/4 by 4 1/2 inches. When the turret is put on the lathe at the factory, holes of any size up to 1 inch can be bored in the turret faces to suit the customer's specifications. The turret will take No. 2 tools, which project 9 1/2 inches from the turret face.

The turret is indexed automatically when withdrawn by means of the pilot wheel or it can be spun by hand in either direction to bring any face into the working position. The forward feeding motion of the ram is automatically disengaged when the stop-screws move against the trip. The ram has a travel range of 6 1/4 inches with either power or hand feed.

The drive for the turret apron is taken from the feed-rod; thus the full range of feeds (0.0025 to 0.144 inch) is available, permitting quick selection by means of the quick-change feed-box. The turret apron is similar in design to the regular carriage apron, and has all its advantages, including positive feed and automatic forced lubrication. A safety device releases the feed when too much pressure is put on the tool or the forward movement of the ram is obstructed. The turret unit weighs approximately 250 pounds. 56

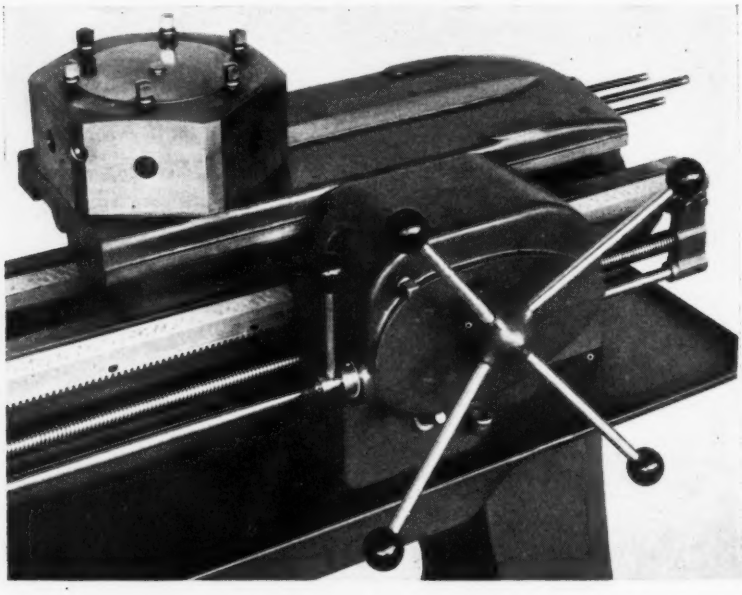
Redmer Collet Air Chucks

The Redmer Air Devices Corporation (formerly the Red-E-Air Chuck Co.), 601 W. Washington Blvd., Chicago 6, Ill., has announced new sizes of the Redmer air chuck which increase the capacity range of this line to 1 3/4 inches. B & S type screw machine collets can be employed in these new chucks for holding work that must be accurately centered and positioned for depth. Inaccuracies due to variations in the diameter of the parts are eliminated, since the chuck is so designed that the collet remains in a fixed position without endwise movement. The larger chucks have the advantage of increased clamping pressure for holding parts while performing milling, drilling, tapping, threading, assembling, or similar operations. They can be adapted for use on different jobs by simply changing the collet and work-stop. 57

Surface Finish Comparison Standards

Closer tolerances on machine parts and higher operating speeds have focussed attention on "surface finish" characteristics and the need for some means of specifying or measuring the degree of roughness of a finished surface. To meet this need, the University Machine Co., 33 University Road, Cambridge 38, Mass., has developed the set of surface finish comparison standards shown in the illustration.

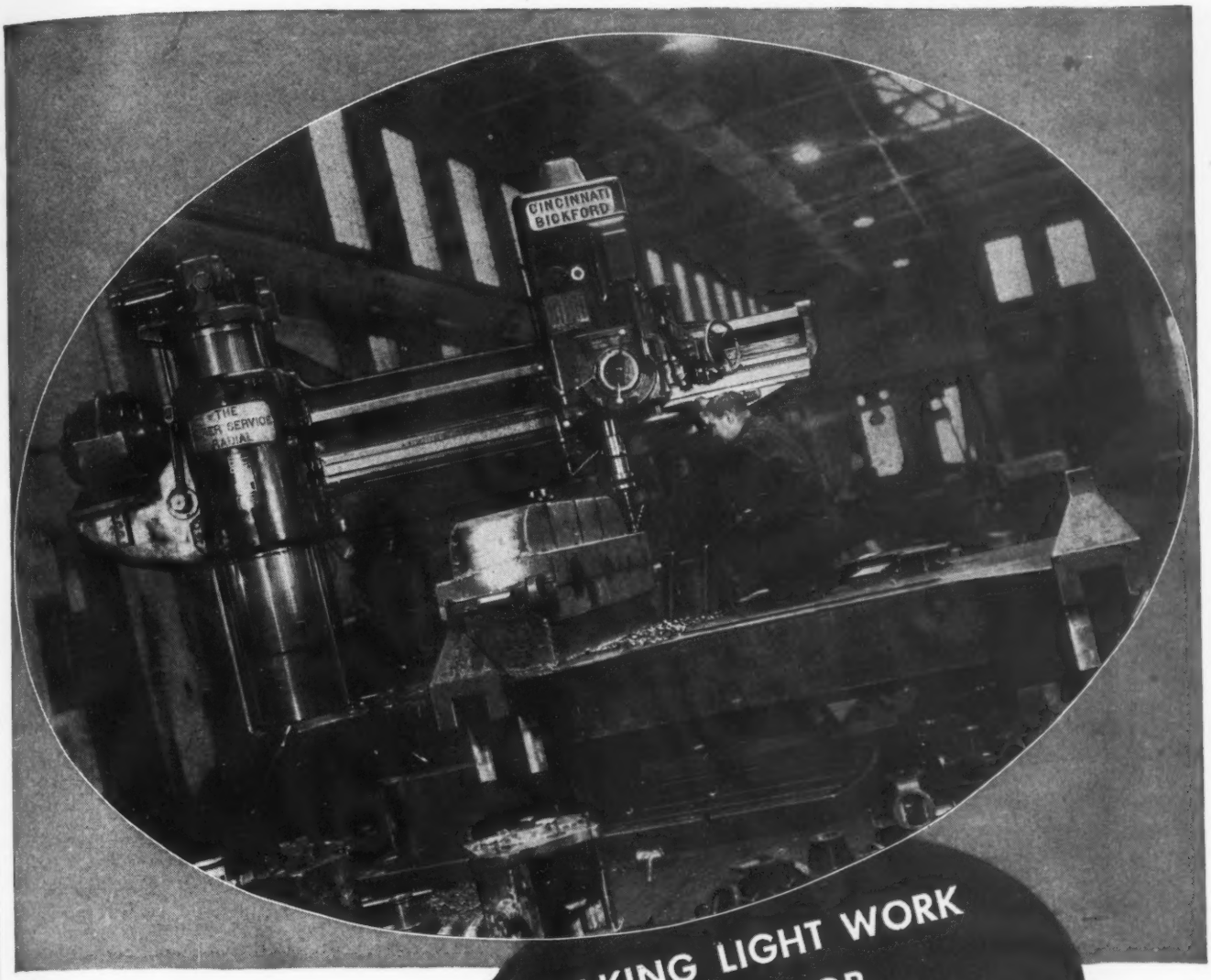
This set is composed of twenty-three specimen blocks covering a roughness range of from 0.000002 inch (r.m.s.) to 0.0005 inch (r.m.s.). These blocks are of stainless steel, and include representative examples of the finishes produced by ordinary machine tool operations, such as polishing, grinding, turn-



LeBlond Hexagonal Ram Type Turret Applied to Regal Lathe

Blocks for Comparing Surface Finish

To obtain additional information on equipment described on this page, see lower part of page 192.



....MAKING LIGHT WORK OF A BIG JOB ON A SUPER SERVICE RADIAL

• This 8 ft. 19 in. column Super Service Radial has been serving a well-known Canadian plant for more than three years — doing heavy work in a big way. Yet this machine has performed with remarkable ease because it is amply powered, and all controls, centralized at the head, are within easy reach of the operator.

Centralized control has been developed to a high degree on the Super Service Radial. All speed changes in the head, power rapid traverse, easy swinging arm, power clamping of column, power and elevation and electric arm clamping can be manipulated with maximum convenience and minimum effort, thereby making more time available for drilling.

Write for your copy of Bulletin R-24 which contains valuable information on these modern, fast, powerful machines.

ARMY E NAVY

The CINCINNATI BICKFORD TOOL CO.

OAKLEY, CINCINNATI 9, OHIO, U. S. A.

ing, milling, etc. Each specimen is engraved with the machine operation and micro-inch reading.

With these standards, a machinist or inspector can check the roughness of a machine surface by comparing the standard specimen with the part under test. It is stated that a fingernail drawn across a finished surface is sufficiently sensitive to detect roughness differences of only a few millionths inch. Each specimen has a separate compartment in the felt-lined case. 58

Sav-Way Internal Grinder with Electro-Hydraulic Control

High-speed table feed and provision for short table stroke adjustments are features of a hydraulically operated, electrically controlled internal grinder placed on the market by Sav-Way Industries, Box 117, Harper Station, Detroit 13, Mich. When the minimun length stroke of 5/32 inch is being used with rapid table feed and reverse, the action of the grinder is so extremely fast that it resembles that of a machine gun. In keeping with this characteristic, the grinder has been designated the "Spitfire."

Solenoid-operated valves and aircraft type micro-limit switches provide constant control, reducing time lag to a minimum. Other features include flexibility, ease of operation, and facilities for quick loading and unloading. In addition to electro-hydraulic control, the machine is also equipped for hand table feed, which can be engaged and disengaged by moving the handwheel out of or into engagement with a rack and pinion feed.

The grinder is available with manually or electrically controlled power cross-feed. The electrically operated cross-slide ratchet gives a feed of 0.0001 inch per tooth or the equivalent of an increase of 0.0002 inch in the diameter of the hole being ground. The cross-slide feed handwheel is graduated in increments of 0.000125 inch.

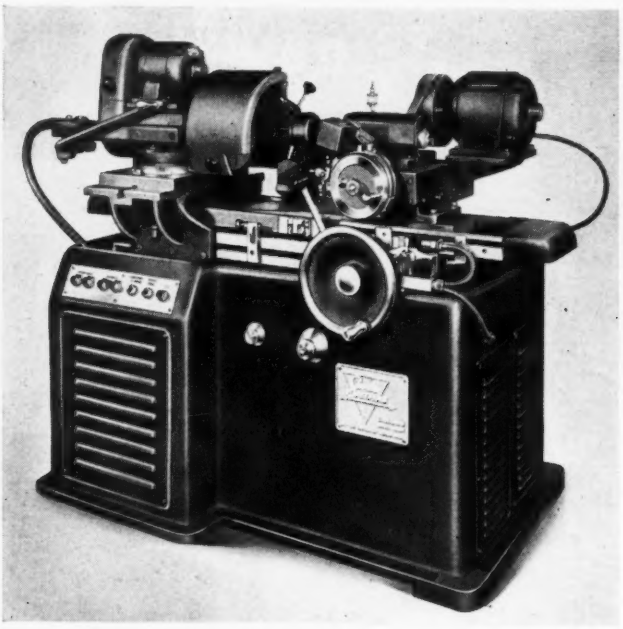
The standard machine is equipped with a manually operated wheel-truing mechanism having a cam return, but is also available with a semi-automatic diamond wheel-dresser. This electrically operated dresser has an adjustable slow-down movement for the table traverse when the wheel is being dressed, and is protected by a mechanism that prevents damaging the machine through careless operation. A unique self-ventilating feature provides a constant flow of oil-air mist through the working parts of the spindle, keeping it free from dirt and coolant.

The spindle is driven by a 3-H.P., 3600 R.P.M., totally enclosed, fan-cooled, ball-bearing motor. The work-head spindle is driven by a 1/2-H.P., 1140 R.P.M., enclosed type motor. Work-head spindle speeds of 90, 145, 235, and 365 R.P.M. are provided by an adjustable V-belt drive. 59

Dust Collector for Grinding and Polishing Equipment

The Standard Electrical Tool Co., 2500 River Road, Cincinnati 4, Ohio, has brought out a new compact, self-contained dust collector, known as the "Air-rester," for use on all types of grinding, buffing, and polishing machines or wherever the collecting of dust is necessary for the protection of health or expensive machinery.

This collector consists of a lower compartment containing the motor-driven fan and an upper dust-collecting chamber fitted with flame-proof steel pads for filtering the air, which is returned to the room without perceptible dust or the creating of objectionable drafts. It is available in four sizes, with capacities ranging from 300 to 1200 cubic feet per minute. The complete unit is 47 inches high, and requires a floor space of 24 by 24 inches. 60

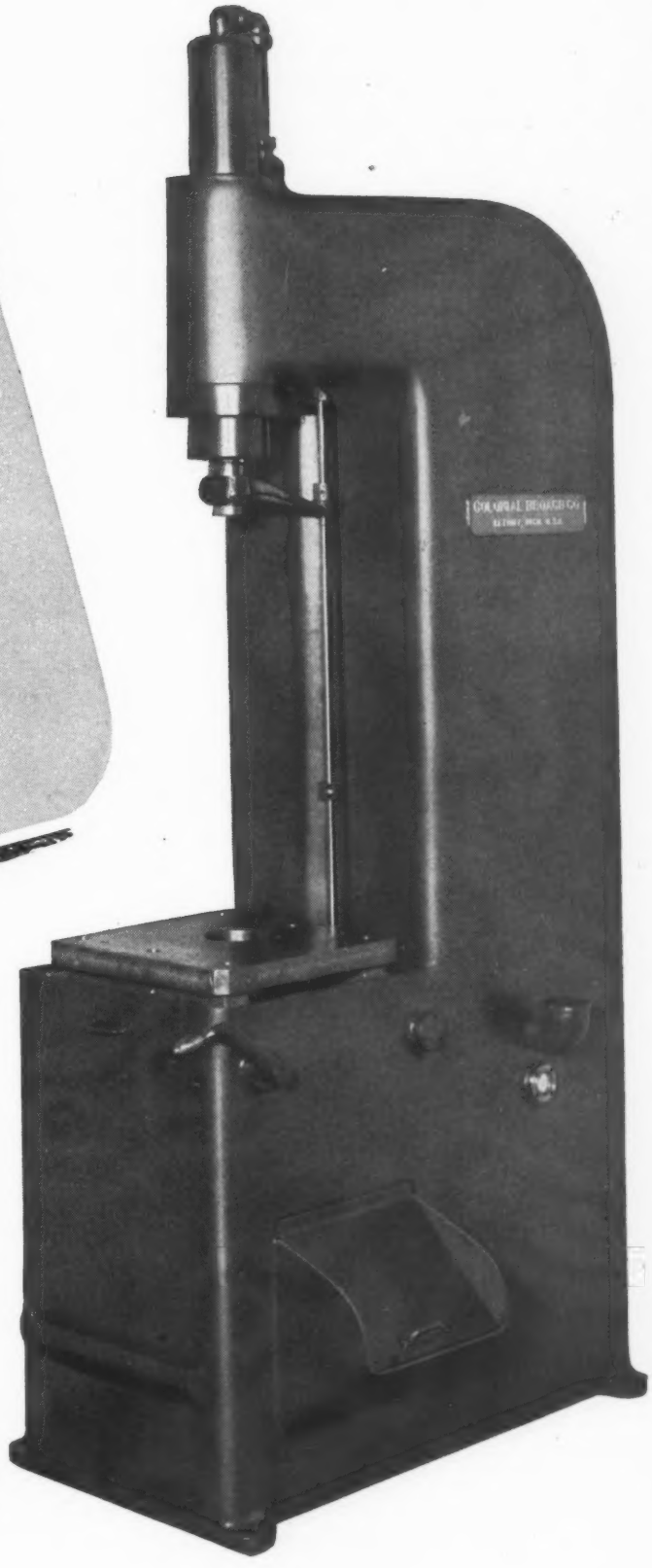


Internal Grinder with Electro-hydraulic Control Brought out by Sav-Way Industries

"Air-rester" Dust Collector for Grinding and Polishing Equipment

To obtain additional information on equipment described on this page, see lower part of page 192.

11 COLONIAL SURFACE BROACHING MACHINES *now do the job of* 60 MILLING MACHINES *in producing* 66 DIFFERENT PARTS *in* 13 OPERATIONS EACH



You can figure for yourself what that means in the way of flexibility and of savings in manpower, capital investment and manufacturing cost. However, if you would like the whole story, ask for a copy of Colonial's

BROACHING NEWS, Vol. 5, No. 4

(Right) One of the most flexible of machines, this Utility Press—one of the machine types referred to above—may be used for both broaching and other types of press work. It is thus well adapted to the requirements of the smaller or medium-sized shop as well as where higher production is required.

colonial BROACH COMPANY
DETROIT 13, U.S.A.

Broaches *Broaching Machines - Broaching Equipment*

Wardwell Automatic Universal Flute Grinder

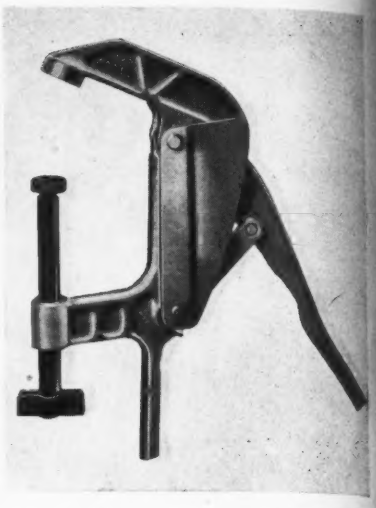
A No. 50F automatic universal flute grinder has been brought out by the Wardwell Mfg. Co., 3168 Fulton Road, Cleveland 9, Ohio, for the wet or dry grinding of straight and spiral flutes from the solid in tools such as straight and taper pin reamers as small as 1/16 inch in diameter, small counterbores, side milling cutters, and angular cutters. This grinder is also adapted for sharpening saws from 1/2 inch up to 8 inches in diameter and in gangs up to 3 3/4 inches long.

The reciprocating slide is operated by an eccentric which is adjustable for any stroke up to 5 inches. The slide can be started or stopped quickly and can be speeded up to suit the work. The work is automatically fed through an index-plate fastened to the end of the arbor. The spacing range is from two flutes to twenty teeth to the inch. The machine can be furnished to handle helical work on special order.

The standard machine is operated by a 3/4-H.P. motor running at 1800 R.P.M. A grinding wheel 8 inches in diameter by 1/4 inch thick with a center hole 3/4 inch in diameter is employed. A diamond dresser mounted in the fixture can be furnished on special order. The machine requires a floor space of 22 by 22 inches, is 56 inches high, and weighs 600 pounds. 61

Improved C-Clamp

Knu-Vise, Inc., 2208 Eighth St., Detroit 16, Mich., has just announced a Model 505 C-clamp of greater strength and substantially reduced weight, as compared with previous models. The streamline forging used for this clamp is designed to facilitate handling, and has an increased throat capacity which enables it to accommodate a wider range of work. A wing-nut is provided for adjusting the gap to suit the thickness of the work. When once adjusted, the clamp retains its exact setting. 62

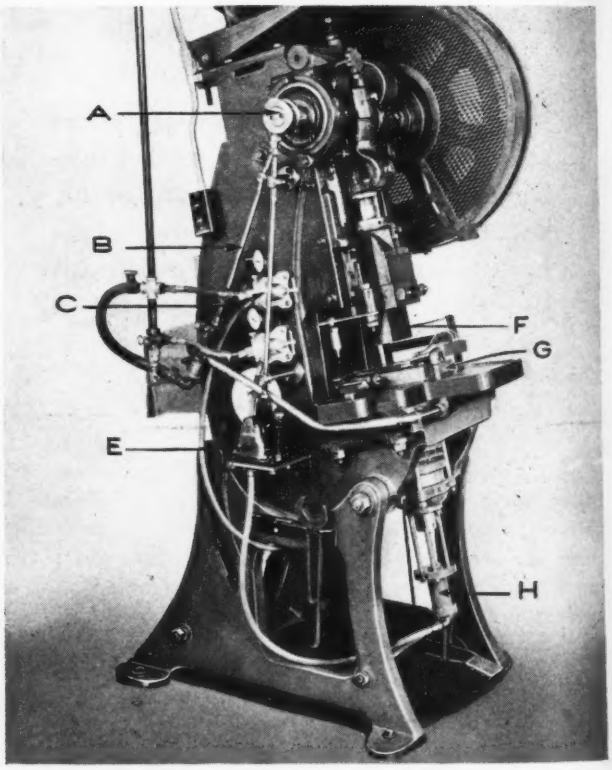


Knu-Vise Improved C-clamp

Dayton Rogers Cushion Blanking Dies

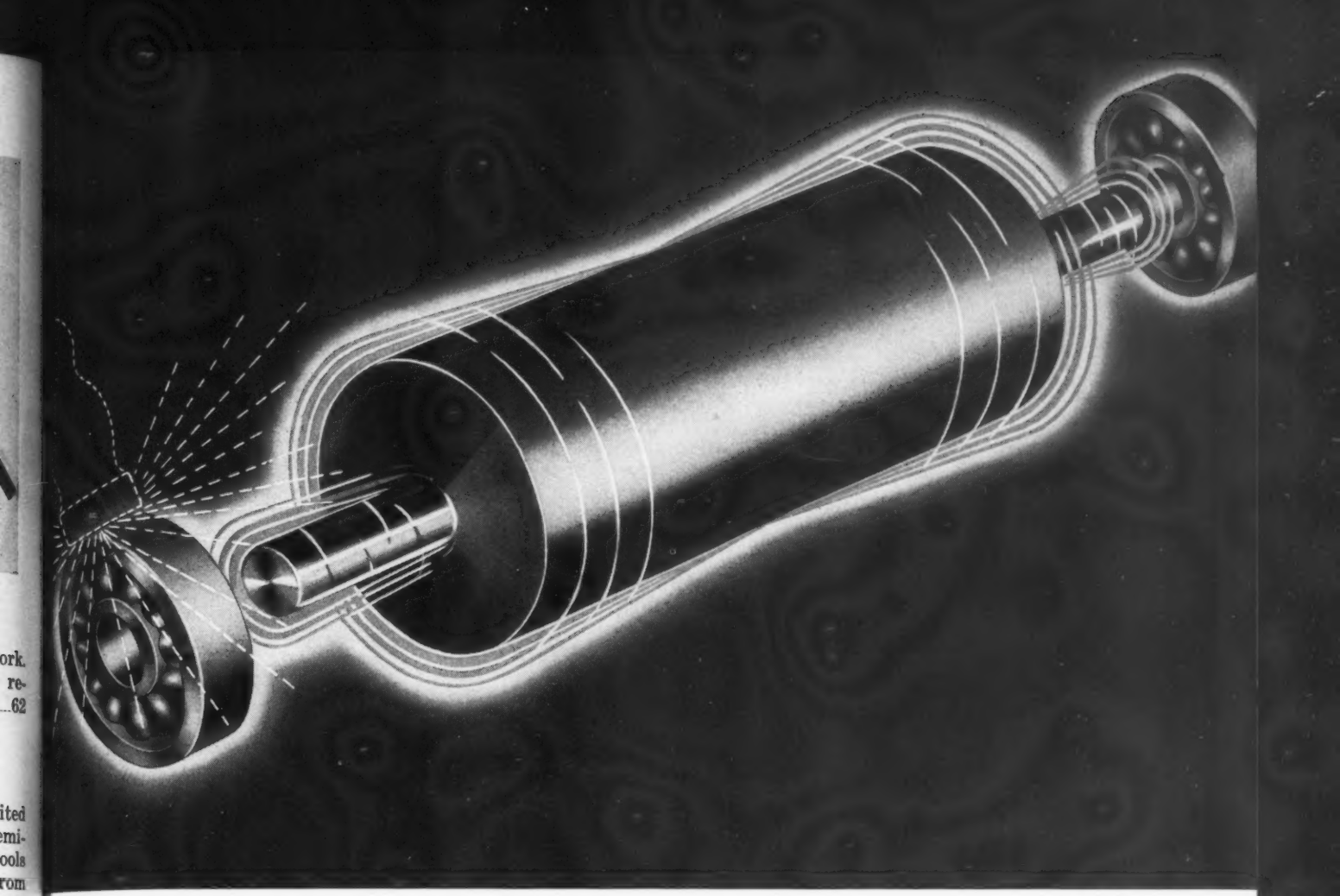
An improved technique for producing custom-made flat die-cut stampings has been developed by the Dayton Rogers Mfg. Co., 2835 Twelfth Ave. South, Minneapolis 7, Minn. The method is intended primarily to meet the requirements of manufacturers desiring a limited number of die-cut parts on a semi-production basis. Blanking tools can be made by this process at from 10 to 25 per cent of the cost of conventional permanent blanking dies. They will have a die life of from

Universal Flute Grinder Brought out by the Wardwell Mfg. Co.



Dayton Rogers Equipment for Blanking on a Semi-production Basis

To obtain additional information on equipment described on this page, see lower part of page 192.



What a beating these bearings would take!

THIS is what you may not *see* when an armature—or any other high speed part—is snugly mounted on its bearings. But you may be sure that the "whip" or "throw" caused by unbalance will deliver a blow at every revolution. And the higher the R.P.M., the harder the blow.

Call it "vibration" if you wish. But remember that vibration means punishment for any high speed assembly . . . punishment that strains, wears, and shortens the life of vital parts.

To eliminate this unbalance and vibration is the job which Gisholt Dynetric Balancing Machines accomplish more quickly, more easily, and more accurately than ever before. If your product can be improved by it, write for full information.

DYNETRIC BALANCING first enables you to *locate* the point of unbalance; then *measure* it for accurate correction. Electronic tubes amplify unbalance vibrations as much as 1,600,000 times.

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10,000 to 25,000 blanks. All piercing operations are taken care of on a secondary set-up, so that the piercing operations are independent of the blanking operations.

Blanking punches from 3/8 to 5/8 inch thick are fastened on a sub-bolster *G*. Hardened and ground stripping pins are nested around the blanking punch and pass through the sub-bolster *G*. The stripping pins are actuated by a pneumatic die cushion fastened to the press bed frame. The blanking die is supported by the stripping pins and is brought into action by a hardened and ground pressure punch pad *F*.

Two cams fastened to the crank *A* control two valve rods *B* and *C*, which open and close air valves *E*. A combination pressure gage and regulator allows the operator to increase or decrease the air pressure required on the pneumatic die cushion and the small air cylinder *H* that operates an ejector for removing the blanks from the die.—63

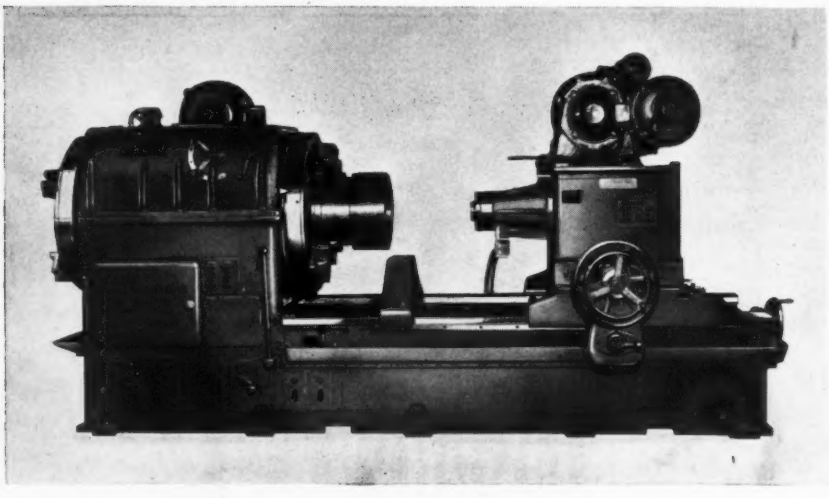
Smalley-General Heavy-Duty Thread Milling Machine

A heavy-duty thread milling machine intended for large-diameter, as well as long, threads, has been brought out by the Smalley-General Co., Bay City, Mich. To indicate the capacity of this No. 44MB machine, it may be mentioned that it will mill a thread 18 inches in diameter, 12 1/2 inches long, 1 1/4 threads per inch. The machine will swing 44 inches in diameter, and has an 18 1/2-inch hole through the spindle.

The milling spindle can be rotated at any speed within a very wide range; when turning is required, turning speeds 125 times faster than the milling speeds can be instantly obtained.

The well-known Smalley-General feed mechanism is used. Threads from 1 to 14 per inch can be milled. The wear of the lead-screw is distributed over a screw 20 inches long, used for no other purpose but to obtain the correct lead. Any wear on the nut can be taken up.

The main spindle and the milling spindle are both mounted in tapered roller bearings, each motor-driven through V-belts. The motors are so wired that if one motor stops during the cut, both will stop, thus preventing the damage that would result if the milling-head motor alone stopped. The motors can, however, be operated independently. The machine weighs about 26,500 pounds.—64



Smalley-General Heavy-duty, Large-capacity Thread Milling Machine

DoAll Welder for Salvage and Extension Welding of Small Tools

A butt-welder has just been introduced on the market by Continental Machines, Inc., 1301 S. Washington Ave., Minneapolis 4, Minn., which is designed to extend the application of the band saw butt-welder to the making of extensions on small tools, salvaging broken tools, and small miscellaneous welding operations. With this new butt-welder, steel rods, steel tape, wire, and wire forms up to 3/8 inch in diameter can be welded. Extension shanks can be quickly welded to drills, screwdrivers, arbors of small grinding wheels, taps, reamers, and cutting tools by inexperienced operators. Besides welding these small tools, the butt-welder can be used to join the ends of all types of band saws in widths up to 1 1/4 inches. Recently this machine has been employed for welding the tubular rip-cord rings for parachutes.

DoAll Welder Designed for Operations on Small Tools

The welder is completely automatic, and is designed for easy operation. First the parts to be welded are inserted and clamped in the welding jaws; then the welding switch is pressed, after which the annealing switch is pressed. The final operation consists of dressing off the weld flash. All these operations are accomplished on the butt-welding unit, which provides all the facilities for welding, annealing, and grinding to remove the flash.

An electric etching attachment is also available for operation with the welder. This attachment is designed to provide means for marking tools, templets, parts, etc. It is clamped to one of the welding jaws, and the marking is done with an etching pencil.

The new butt-welder is available in two models, each having the same capacity. One is a table type designed for portability, while the other is a pedestal type, and contains storage space for coiled band saw or other stock.—65

To obtain additional information on equipment described on this page, see lower part of page 192.

TASK FORCE OF TOOLS

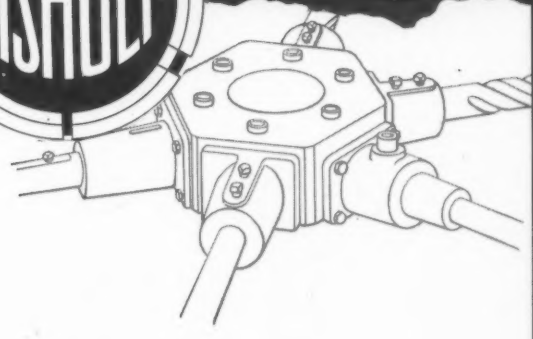
CONVERGES ON OBJECTIVE!

GISHOLT

It doesn't take long to perform any machining task when you bring tools into play in rapid succession like this on a Gisholt Turret Lathe. This kind of rapid-fire production is bringing V-day closer.

And when the hurry of war production is over, your Gisholts can be used for peace-time products. Then, their speed and precision will bring you lower manufacturing costs.

The ability of Gisholt Turret Lathes to handle an amazing variety of metal turning work, makes them the Number One production tool in thousands of shops. Write for a copy of the new Gisholt general catalog.



TURRET LATHES
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LOOK AHEAD . . . KEEP AHEAD . . . WITH GISHOLT IMPROVEMENTS IN METAL TURNING

Gages for Checking Aeronautical Pipe Threads

A complete line of gages designed to provide for rapid, accurate checking of all pipe threads made to the latest Army and Navy Aeronautical Pipe Thread Specifications known as Spec. An-GGG-P-363, Amendment No. 2, Symbol ANPT, has been brought out by Pratt & Whitney, Division Niles-Bement-Pond Co., West Hartford, Conn.

For checking internal threads, there is a double-end gage *A*, Fig. 1, carrying the L1 and L3 thread plug gages which check lead, form, diameter, and taper. These are followed by a plain taper plug gage *B*, which checks taper, roundness, and minor diameter. The L1 and L3 plug gages have three steps for classifying the thread, while the plain taper plug gage is provided with six steps.

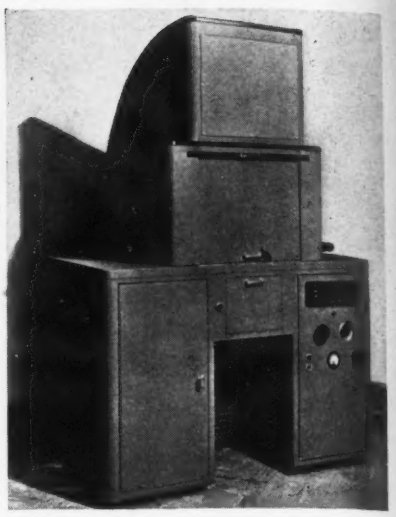
For checking external threads, there is a set of two special ANPT "Tri-Roll" gages. The first, shown at *F*, Fig. 2, is a thread gage which checks the lead, form, taper, and pitch diameter. Three steps on the top of the gage classify the thread. The second, shown at *G*, is a plain taper gage for checking taper and diameter of threads at the crest. This has a stepped plunger and three steps on the bottom of the gage to facilitate classifying the thread. Setting plugs *H* and *J* are supplied with each of these special Tri-Roll gages.

An alternate method for checking external threads, approved by the Army and Navy, employs a set of three ring gages *C*, *D*, and *E*, Fig. 1, which can also be supplied by Pratt & Whitney. They are the L1 or thin thread ring gages, and the L2 or thick thread ring gage. These gages are designed to provide the same check as the Tri-Roll method described, but require more time for the application of the gaging operation. 66

"Norelco" Electronic X-Ray Unit for Internal Inspection of Castings

The North American Philips Co., Inc., 100 E. 42nd St., New York 17, N. Y., has recently brought out an industrial X-ray unit for the internal inspection of castings, parts, and assemblies. This Model 150 "Norelco" electronic "Searchray" is designed to locate flaws and defects within the metal, giving sharp definition of defects when examining objects which are within its capacity. Using one-minute exposures, a penetration of 4 inches in aluminum, 3/4 inch in steel or cast iron, and 1/2 inch in copper and brass can be expected. Greater thicknesses can be radiographed by using intensifying screens and by increasing the time allowance for the exposure.

Non-destructive internal examination of an object is accomplished by placing it in the specimen compartment, where it can be positioned by means of the built-in fluoroscopic screen for making the radiograph. This eliminates the trial-and-error method, and results in a saving of film and time. After the object is in the desired position, the proper kilovoltage is selected by the adjustable control having a direct-reading scale. The film is then inserted, the time set, and the exposure made. The specimen compartment is 16 inches high, 36 inches wide, 21 inches deep, and the built-in fluoroscope has a screen 12 by 16 inches. The complete machine is 85 inches high, 59 inches wide, 52 inches deep, and weighs 1200 pounds. 67



Electronic X-ray Unit Brought out by North American Philips Co.

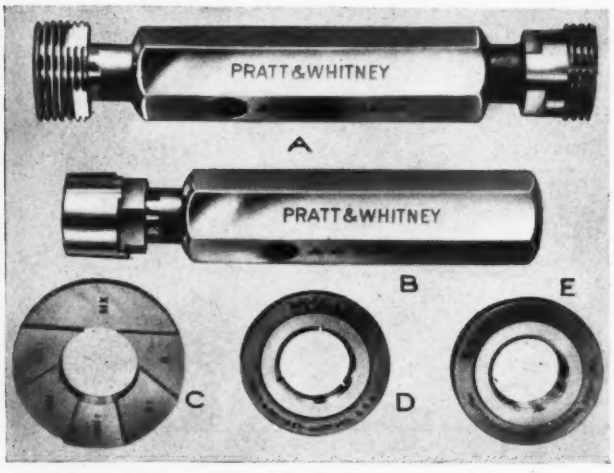


Fig. 1. (A) P&W Gage for Checking Lead, Form, and Taper of Internal Aeronautical Pipe Threads. (B) Plain Taper Plug Gage Used with Gage A to Check Taper, Roundness, and Minor Diameter. (C, D, and E) Ring Gages for External Pipe Threads

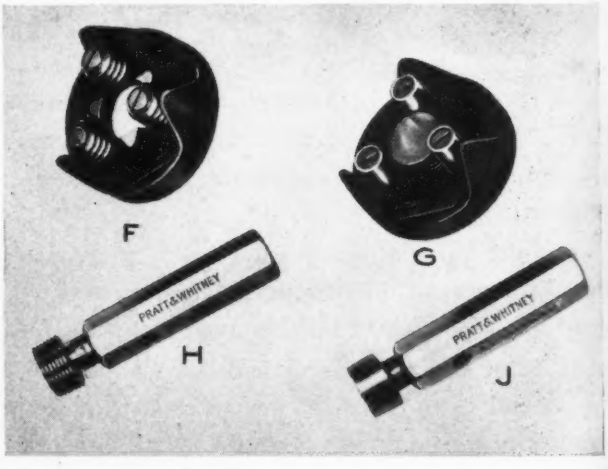


Fig. 2. (F) P&W "Tri-Roll" Gage for Checking Lead, Taper, and Pitch Diameter of External Threads (G) "Tri-Roll" Gage for Checking Taper and Diameter of Threads at Crest. (H and J) Plugs for Setting Gages F and G

To obtain additional information on equipment described on this page, see lower part of page 192.

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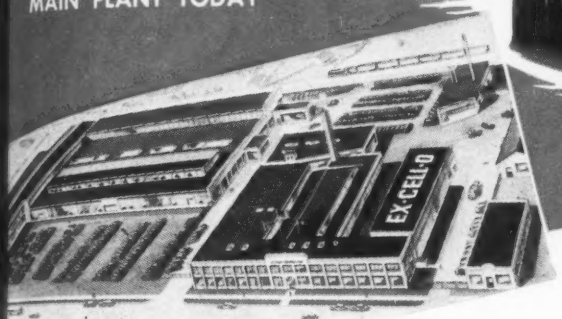
★ EX-CELL-O AIRCRAFT PARTS DIVISION



DURING ITS FIRST 25 YEARS
EX-CELL-O HAS MADE "PRODUCTION" HISTORY FOR THE NATION

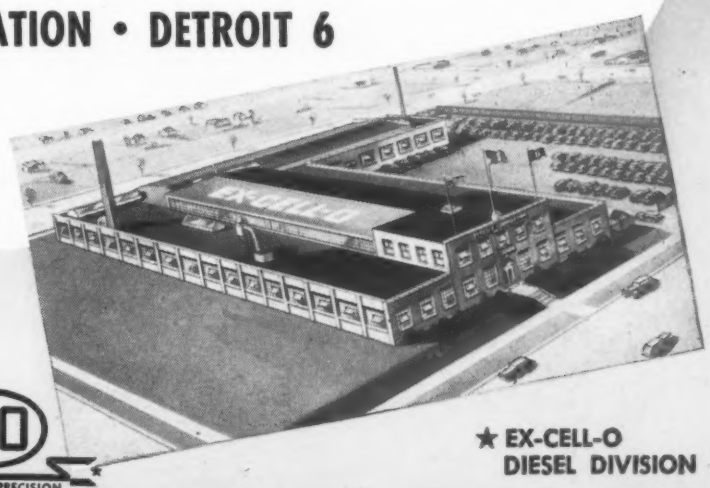
Ex-Cell-O was founded a quarter of a century ago with a practical ideal—to bring to metal-working industries a new high standard for accuracy and speed in mass production. Steadfastly through the years it has progressed in this direction. Ex-Cell-O was the first company in the United States to design and manufacture and introduce for successful commercial use: *a precision ball bearing internal grinding spindle . . . a precision horizontal-type diamond boring machine . . . a precision thread grinding machine . . . a precision cylinder boring machine . . . a 1½ horsepower compact hydraulic power unit . . . a Diesel fuel injection pump and a universal-type Diesel engine nozzle . . . a machine to form and fill automatically square paper milk bottles in the dairy . . . Ex-Cell-O was also the first American company to undertake the mass production of hardened and ground precision parts for airplane engines.* If you are planning for tomorrow, when new standards will necessitate costs that are competitive, take advantage of Ex-Cell-O's wide engineering experience and extensive manufacturing facilities.

EX-CELL-O CORPORATION • DETROIT 6

EX-CELL-O MACHINE TOOL DIVISION

XLO

EX-CELL-O for PRECISION



★ EX-CELL-O DIESEL DIVISION

SPECIAL MULTIPLE WAY-TYPE PRECISION BORING MACHINES • SPECIAL MULTIPLE PRECISION DRILLING MACHINES • PRECISION THREAD GRINDING, BORING AND LAPPING MACHINES • BROACHES AND BROACH GRINDING MACHINES • HYDRAULIC POWER UNITS • GRINDING SPINDLES • DRILL JIG BUSHINGS • CONTINENTAL CUTTING TOOLS • TOOL GRINDERS • DIESEL FUEL INJECTION EQUIPMENT • R. R. PINS AND BUSHINGS • PURE-PAK PAPER MILK BOTTLE MACHINES • PRECISION AIRCRAFT AND MISCELLANEOUS PARTS

DoAll Optical Flats and Monolight

Greater wear resistance and a lower coefficient of expansion are features of the new DoAll optical flats manufactured from fused Brazilian quartz by Continental Machines, Inc., 1301 Washington Ave. S., Minneapolis 4, Minn. These flats are adapted for the accurate inspection of master flats, flat surfaces of gages, machine parts, micrometer anvils, comparators, and steel bars. They are made in six sizes, ranging from 2 to 10 inches in diameter. Each flat is packed in a hard-wood case. They are available in the laboratory grade for gage-block and instrument inspection to an accuracy of one-millionth inch, and for fine tool and instrument checking to an accuracy of two-millionths inch.

This company has also brought out a monochromatic light having a large range of adjustability, combined with compactness. Helium light rays are used in this light to give, in a highly purified form, one wave length of light which is readily distinguished by its yellow color. This high-intensity light can be concentrated on a small area to give greater illumination for distinguishing the light-wave unit known as the "fringe" or interference band. With this equipment, it is possible to read to millionths of an inch any variations in the size and flatness of parts when viewed through the combination of optical flat and Monolight. The maximum height from the Monolight lamp to the table is 12 inches. ----------68

Monarch "Shape Master" for Handling Work up to 16 Inches in Diameter

Monarch Shape-Turning Lathe

A shape-turning lathe that will handle work up to 16 inches in diameter has been placed on the market by the Monarch Machine Tool Co., Sidney, Ohio. This "Shape Master" makes possible turning, boring, or facing to almost any desired shape. As examples of work for which this machine is suitable may be mentioned oval-shaped bottle molds, dies for glass or plastic dishes, and punches or spinning chucks for silverware and hollow ware of all types. An oval dish mold with as many as sixteen flutes can be machined completely in 2 1/4 hours, and the original mold can be exactly duplicated as many times as required.

The mechanism consists of three elements—one controls the shape cut; another regulates the rate of repetition of the shape on any given circumference; and a third controls the contour generated on successive diameters. The tool-actuating mechanism, mounted on the carriage cross-bridge, is cam-operated. The master cam records only a single element or unit of the desired de-

Fig. 1. DoAll Optical Flats for Precision Inspection of Small Parts

Fig. 2. Monolight Designed for Use with Optical Flats Shown in Fig. 1

To obtain additional information on equipment described on this page, see lower part of page 192.

POWERED WITH THREE STERLING ADMIRAL ENGINES

A LIGHTNING blur as the slim, grey hull streaks in—a white trail of foam on an azure sea—a blinding flash—a thunderous roar—and it's "bottoms up" to another enemy ship.

Swift, powerful, deadly, despite their midget size, the mosquito fleet has struck terror to enemy shipping in every theatre of operation.

And the success of these small craft is due largely to the Sterling engines in their holds—engines so powerful that they have aptly been called "masterpieces of precision design."

Compactness and precision are characteristic, too, of the Foote Bros. gears that aid these engines in delivering their power. For today, these high precision gears are being turned out on a production basis made possible by new manufacturing techniques—new production know hows.

When the war is won, such high precision Foote Bros. gears will offer American manufacturers new efficiencies in power transmission for machines of peace.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5225 South Western Boulevard, Chicago 9, Ill.

FOOTE BROS.

Better Power Transmission Through Better Gears

sign or pattern. In a fluted dish mold, for example, the master cam would represent the curvature of a single flute only. The repetition of the shape to be cut is determined by the geared relationship of the cam and the spindle revolutions. The machine is provided with sufficient change-gearing to give a range up to 500 shapes or tool actuations per revolution of the work. This machine further simplifies the work of shape generation by making its own master cams.

The over-all contour of the work can be produced in two different ways. A stroke-compensating device makes it possible to maintain the same shape over a constantly increasing or decreasing diameter of the work-piece. Irregular contours can be obtained by the use of a metal templet in conjunction with Keller electrical controls. 69

Reliance Electronic Drive for Machine Tools

An electronic system of adjustable-speed drive, operated from the regular polyphase, alternating-current line of 220, 440, or 550 volts, two- or three-phase, 25, 50, or 60 cycle, to provide speed changes over a range of 20 to 1 or better, has been announced by the Reliance Electric & Engineering Co., 1088 Ivanhoe Road, Cleveland, Ohio. A substantially wider range of operating speeds can be obtained for such applications as machine tool feeds, where the actual load on the motor is light. This electronic drive will be available in 1-, 1 1/2-, 2-, 3-, and 5-H.P. sizes.

Advantages claimed for this drive are closer regulation of speed where wide changes in load occur, and smaller size of speed controlling elements, which may be especially advantageous in applications on automatic machines. Controlled starting torque and controlled torque for braking and stopping are operating characteristics obtainable with this drive. Starting, stopping, and reversing can be controlled from one or more convenient points.

The drive consists of a small cabinet housing the necessary tubes and transformers, a motor for driving the machine, and a start, stop, and reverse push-button station in which the speed-changing rheostat is incorporated. The functioning of the electronic system drive of the machine shown in Fig. 1 is based on voltage control, the same as in the rotating system. Referring to Fig. 2, the transformer which steps down the voltage of the alternating-current supply for the anode circuit of the rectifier tubes is mounted by itself in the base of the cabinet.

The front of the cabinet is made up of three panels. The panel at the upper right-hand corner carries the excitation tube, all control tubes and transformers, a tap switch for matching alternating-current voltage, and four factory preset rheostats which establish maximum and minimum motor operating speeds, fix the value of the I.R. drop compensation, and determine the rate of starting acceleration of the motor. A 45-second warm-up timer is mounted on the panel directly above the excitation tube.

A second or power panel at the upper left-hand corner carries two, three, or four grid-control tubes for converting alternating to direct current and the transformers for lighting the filaments of these tubes. The single-phase panel up to and including the 2-H.P. size has two tubes rated at 6.4 amperes. The three-phase, 3-H.P. unit employs three tubes of the same type, and the 5-H.P. unit employs four tubes.

The third or control panel extending across the front of the bottom of the cabinet carries all the necessary contactors, relays, etc., for starting, stopping, reversing, dynamic braking, jogging, and other operating functions. All panels have individ-

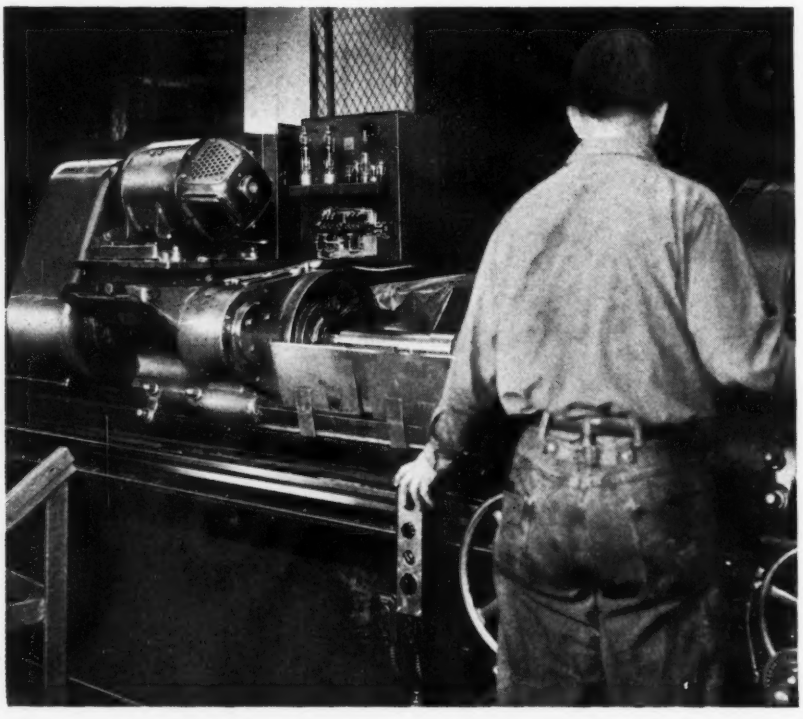


Fig. 1. Lathe Equipped with Reliance Electronic Drive

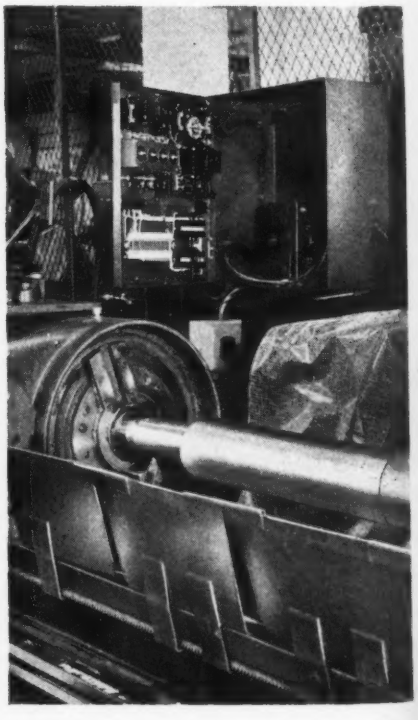


Fig. 2. Electronic Control Cabinet

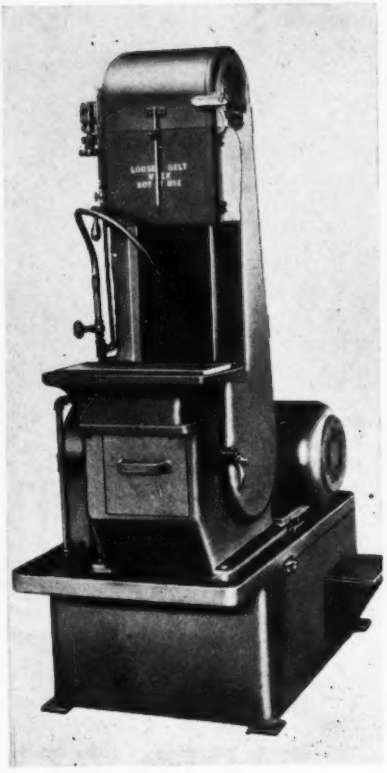
To obtain additional information on equipment described on this page, see lower part of page 192.

ual terminal boards, which facilitates wiring the various control groups. Cable or harness type industrial wiring equipment is used throughout. 70

Sheffield Standardized Air Gages for Checking Bore Diameters

Type and size standards of air-gage spindles for dimensional inspection of internal diameters and bores have been established by the Sheffield Corporation, Dayton 1, Ohio. At present, standards have been set up on "Precisionaire" spindles for checking either "through" or blind holes ranging from 0.300 inch to 1.734 inches in diameter with tolerances from 0.005 inch to 0.00005 inch. All spindles within certain size ranges can be used on Precisionaire instruments of a corresponding tolerance range.

Four types of standard spindle assemblies are available. Types A and A-1 assemblies are used where the gage is presented to the work, and consist of spindle, extension shaft, handle, and air hose. Type A is designed for checking "through" holes, and Type A-1 for blind and counterbored holes. Types "B" and "B-1" are used where the work is presented to the gage, and consist of a spindle and adapter. Type B is used for checking "through" holes, and Type B-1 for checking blind and counterbored holes. 71



Porter-Cable Wet Belt Surface Grinder with Increased Coolant Capacity

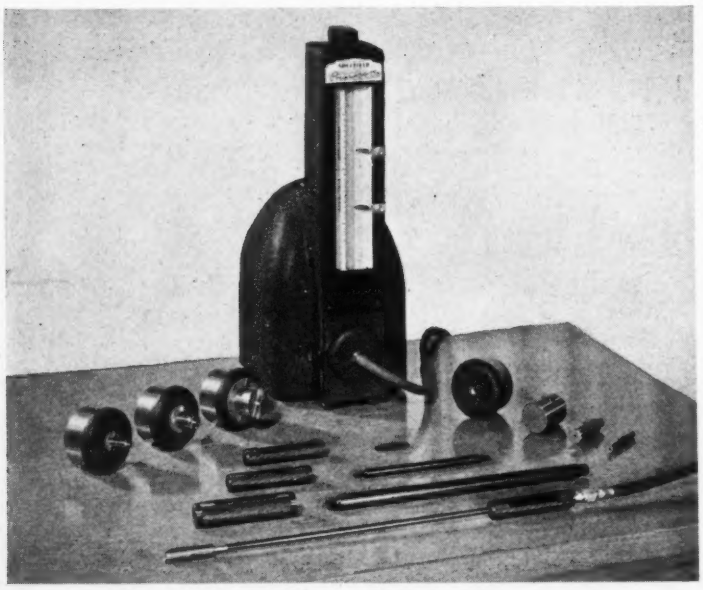
Porter-Cable Wet Belt Surface Grinder

A Model AG-8 wet belt surface grinder has been developed by the Porter-Cable Machine Co., Syracuse 8, N. Y., to meet the demand for a machine having greater coolant capacity and more rigid construction, as required to maintain a higher degree of grinding accuracy than obtainable with earlier models. This new grinder is equipped with a 35-gallon, self-contained recirculating system designed to provide adequate coolant flow under all grinding conditions.

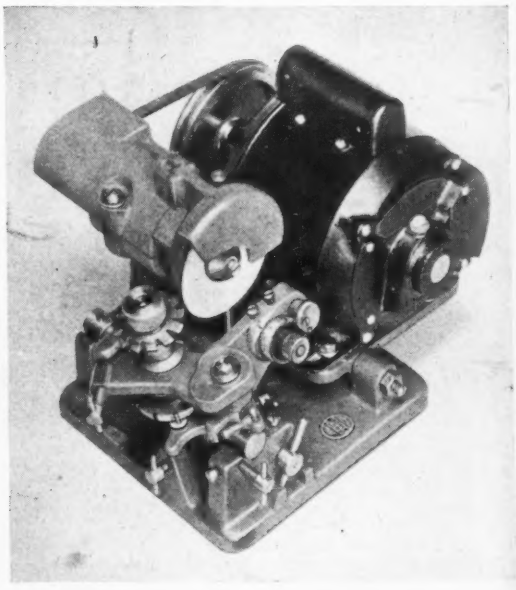
It is claimed that tolerances as close as 0.0005 inch can be held on work finished on this machine, even when it is operated by an inexperienced person. New features include a readily accessible clean-out drawer for waste materials; new "joggle" type switch; higher, more convenient table for the operator; flexible tube to supply coolant where needed and in the desired quantity; and greater platen grinding area. The AG-8 machine shown in the illustration is adapted for grinding steel, aluminum, bronze, magnesium, glass, plastics, fiber, hard rubber, etc. 72

Waltham Cutter Sharpener

A cutter sharpener developed by the Waltham Machine Works, Waltham, Mass., for sharpening their own precision cutters, is being placed on the market by the Edward Blake Co., 634 Commonwealth Ave., Newton Centre 59, Mass. This sharpener is designed for the fast, accurate sharpening of gear-tooth cutters, straight milling cutters, circular form tools, straight-fluted



Air Gages for Checking Bore Diameters, Recently Standardized by Sheffield Corporation



Motor-driven Cutter Sharpener Built by Waltham Machine Works

To obtain additional information on equipment described on this page, see lower part of page 192.

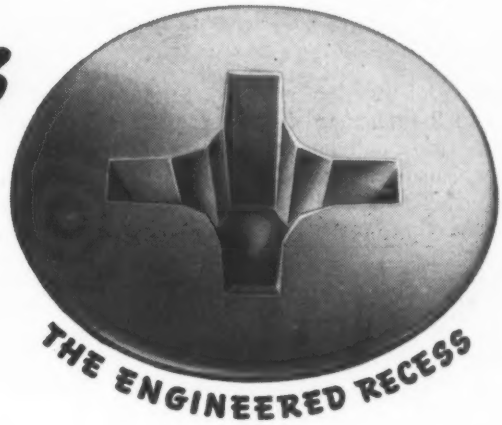
MAKE THIS TEST

AND SEE WHY 90% OF ALL

RECESSED HEAD SCREWS

HAVE THE SAME RECESS

IT'S PHILLIPS



There's nothing like making the *driving test* to convince yourself that there's nothing to match the all-around superiority of the recess design in Phillips Screws! It quickly demonstrates that Phillips is truly a scientifically *engineered* recess in which every angle, every dimension has a definite purpose, contributing to driving ease and speed – and to fastening strength.

Once you make this "driving test" you'll see how Phillips Recess Head Screws fully utilize turning power . . . why your workers can "get going" without fumbling, wobbling, skidding starts . . . can sustain speed and make *consistently tight* fastenings without getting all tuckered out. That's because the driver point *automatically centers* itself in the Phillips Recess, so that screw and driver "handle" like one unit!

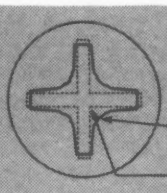
You'll also discover that you can set screws up tight without danger of wrecking the Phillips Recess. Those *rounded* corners of the Phillips design will not crush under pressure. And that rugged screw head won't pop off, either, because the Phillips Recess does not weaken it!

The driving test also explains why the Phillips Recess is found in 90 per cent of all assemblies where recessed head screws are used . . . and why Phillips is the only recess ever ok'd by 23 leading screw makers!

To Make Wartime Quotas and Peacetime Profits . . . get the faster starting – faster driving – stronger, better looking fastenings that only screws with Phillips Recessed Head can give you!

PHILLIPS *Recessed Head* SCREWS

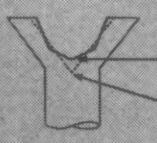
WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS



IDENTIFY IT!

Center corners of Phillips Recess are rounded . . .

NOT square.

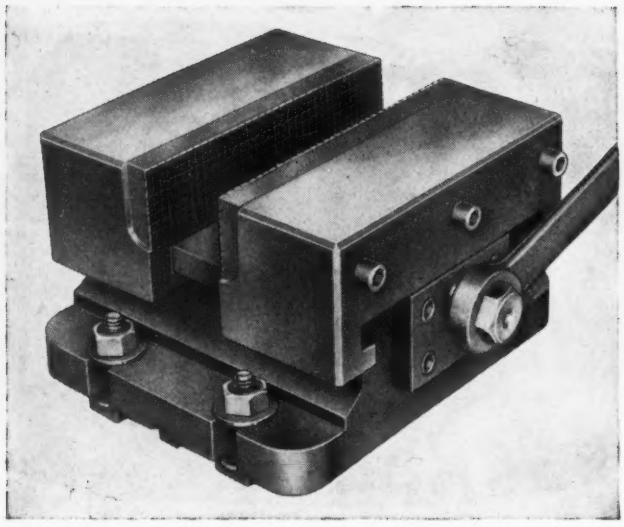


Bottom of Phillips Recess is nearly flat . . .

NOT tapered to a sharp point.

23 SOURCES

American Screw Co., Providence, R. I.
Atlantic Screw Works, Hartford, Conn.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
General Screw Mfg. Co., Chicago, Ill.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
Manufacturers Screw Products, Chicago, Ill.
Milford Rivet and Machine Co., Milford, Conn.
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.



Diamond Self-centering Vise

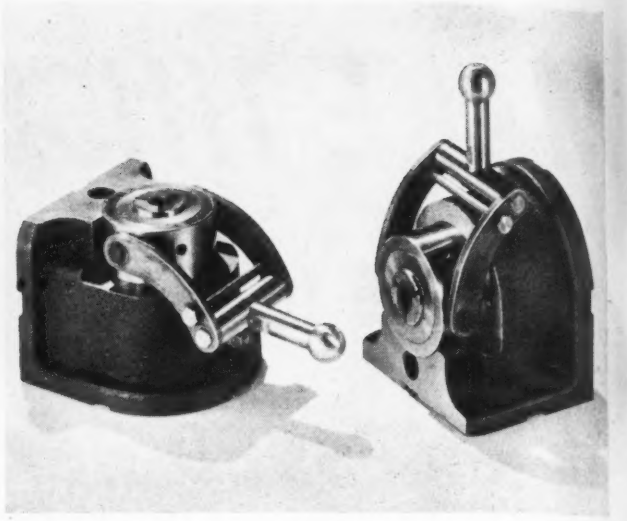


Fig. 1. Zagar Chucking Fixture

hobs, and multiple cutters. Cutters up to 2 inches in diameter by 3/8 inch thick can be sharpened. The machine is designed for bench use, and is operated by a 1/6-H.P. alternating-current motor. 73

Diamond Self-Centering Vise

A self-centering production vise for use on milling, drilling, and shaping machines has been developed by the Diamond Tool Co., 3429 E. Olympic Blvd., Los Angeles, Calif. Both jaws of this vise are actuated by a hardened steel screw having right- and left-hand threads. This arrangement automatically centers the work with the tool, regardless of variations in stock thickness. The bronze nuts in which the clamping screw operates are made as inserts, and are easily replaceable.

The serrated hardened jaws can be removed and replaced by jaws of special shape or design. Four hold-down slots and bolts are provided, and a tongue on the bottom of the vise serves to align the vise jaws with the table edges. The over-all dimensions are height, 4 1/4 inches; width, 6 3/4 inches; and length, 7 1/2 inches. The jaws are 6 inches wide, by 2 inches deep, and have a maximum opening of 2 inches. The vise weighs approximately 36 pounds.....74

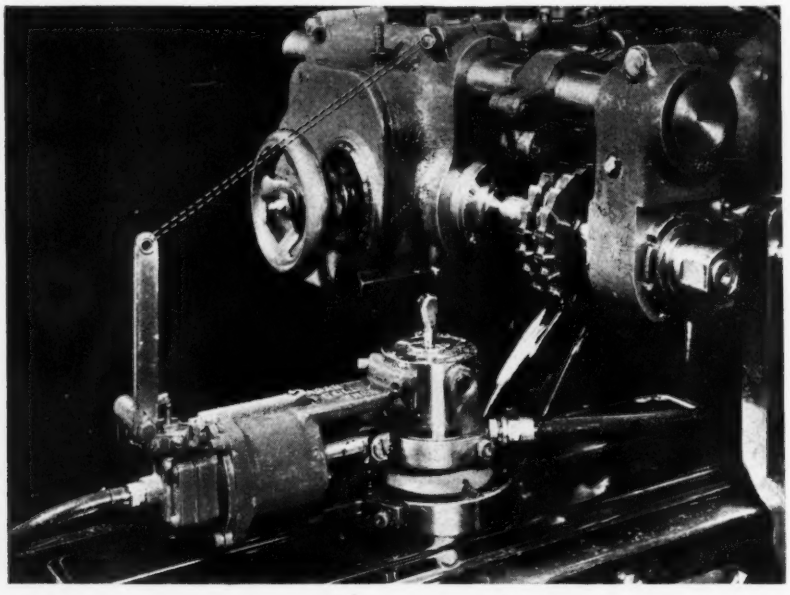


Fig. 2. Zagar Air-operated Fixture

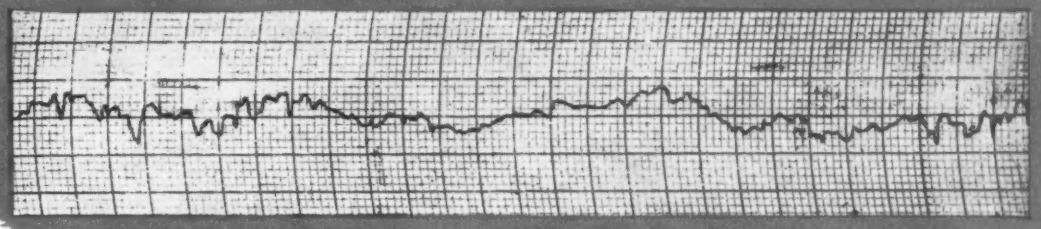
Zagar Work-Holding Fixtures

The Zagar V-H chucking fixture shown in Fig. 1, which is designed to function equally well in horizontal and vertical positions, is a new development of Zagar Tool, Inc., 23880 Lakeland Blvd., Cleveland. 17, Ohio. The body of this fixture has two right-angle milled faces with key-slots cut in two directions on each face. It is adapted for mounting in any position on a drill press or milling machine, and is especially adapted for drilling and tapping cross-holes in round stock. Tapped holes are provided for mounting drill bushings. Cutting oil is forced through the tapped holes and fixture to the work in such a manner as to wash away the chips.

The Zagar "Air-O" fixture shown in Fig. 2, which is designed to retain all the advantages of standard Zagar chucking tools, is another new product. Air is employed in this fixture to actuate the locking and unlocking mechanism and to insure uniform holding power, regardless of variations in the air-line pressure. The fixture is readily adapted to the cycle of the machine on which it is used, whether it be a milling machine, drill press, or automatic machine, thus making the operation completely automatic. The fixture can be operated on any standard 90-pound pressure air line. A rod or chain, arranged as shown in the illustration, can be employed for automatically actuating the fixture at a predetermined position of the table. 75

To obtain additional information on equipment described on this page, see lower part of page 192.

Proof of a Better Finish



Each small square represents 1.0 micro inches. Micro inch r.m.s. = 0.9 — 1.6.

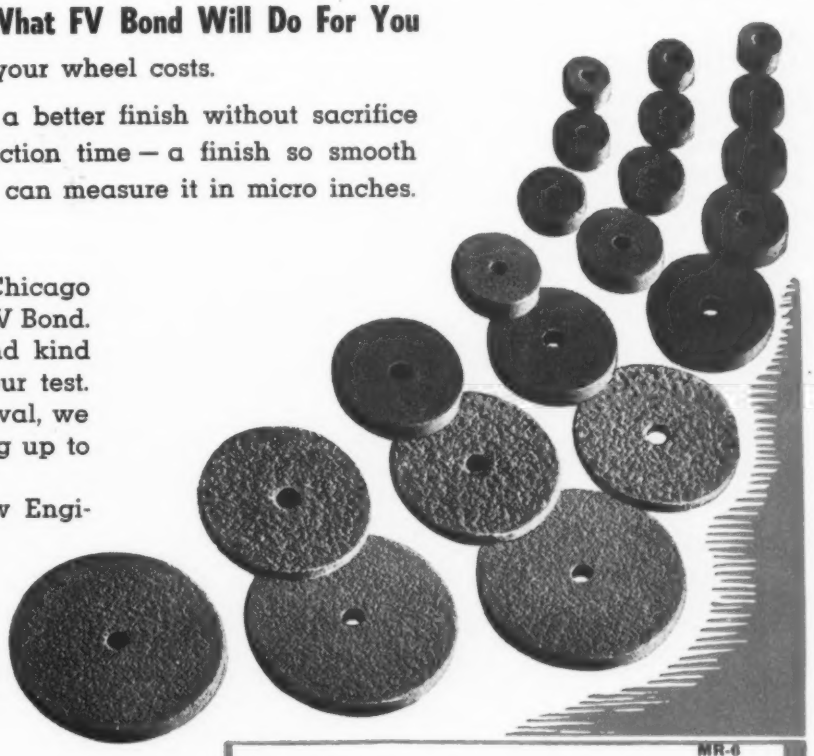
Surface Analyzer Tape Proves you Get a Better Finish with Chicago Wheels

These results were obtained at a rate of 10 pieces per hour in an aircraft parts plant. Material, X-13-15, Rockwell 60 to 57, grinds out .006 to .007 stock. Chicago Wheel used, 1/2 x 1/2 x 1/8", Grain 180, Grade L Arcite FV Bond. Spindle Speed 40,000 r.p.m. Lapping and super finishing eliminated on this job.

Can you match that finish? Sounds phenomenal, but you can do it with Chicago Wheels. And, the secret of their superiority lies in the new FV Bond, developed exclusively for Chicago Wheels, after 50 years' experience making wheels for the most accurate and precise applications.

Here's What FV Bond Will Do For You

- Reduce your wheel costs.
- Produce a better finish without sacrifice of production time — a finish so smooth that you can measure it in micro inches.



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For the duration, with full WPB approval, we are specializing on small sizes—anything up to 3" in diameter.

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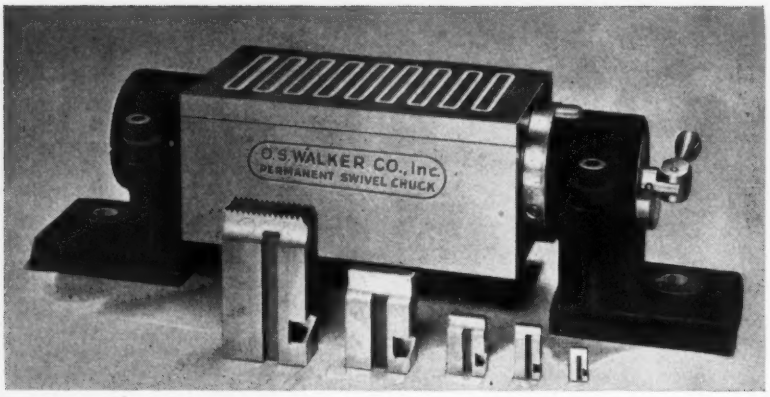
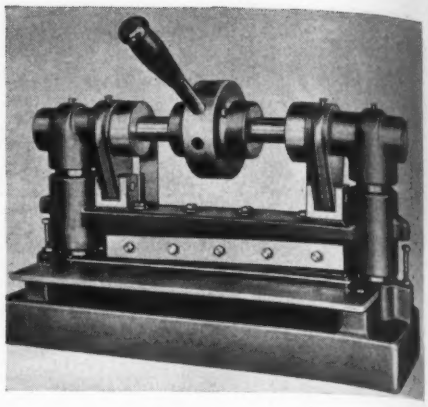
Send Catalog and Survey Form. Interested in ☐ Mounted Wheels. ☐ Grinding Wheels. ☐ Send Test Wheel. Size .....

Name .....

Address .....



Swivel Type Magnetic Chuck Developed by the O. S. Walker Co., Inc.



"Di-Acro" Shear of Improved Design

Walker Swivel Type Magnetic Chuck

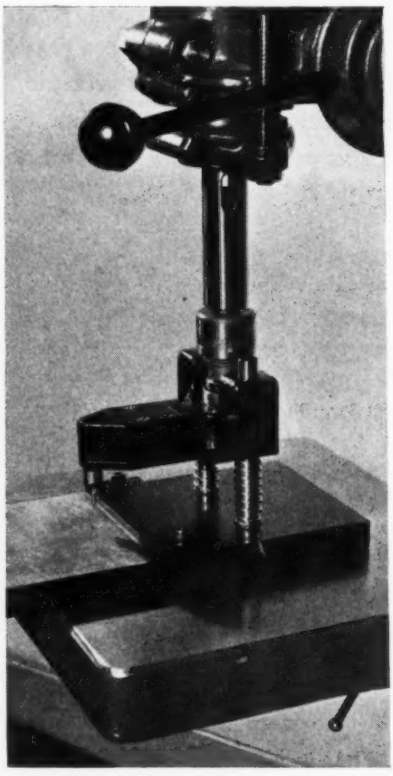
A chuck of the permanent magnet type, designed to provide the same operating advantages and to have magnetic torque plates of the same design and pole divisions as the electromagnetic type, has been developed by the O. S. Walker Co., Inc., Worcester 6, Mass. Auxiliary plates for special work can be applied to the new chucks.

The basic function of demagnetization of the permanent magnet chuck is accomplished by having a movable magnet capable of 180 degrees displacement, so that effective polarities can be adjusted to combine or cancel out their magnetizing effect. At present, the 406 permanent magnet chuck is made in a swivel type especially for tool-room application. Larger sizes have also been developed, the 410 being the principal size in this group.....76

Back Spot-Facer with Offset Head

A back spot-facing device designed to facilitate spot-facing and countersinking holes in inaccessible places has been placed on the market by Edlund Tools, Inc., 4473 Woodward Ave., Detroit 1, Mich. This device is especially designed to reach holes that are obstructed by overhanging flanges, a condition often encountered in aircraft work.

The tool consists essentially of a body casting enclosing spur gear trains which transmit the rotational movement from the drill press spindle to the cutter-spindle in the nose end of the casting. The cutter-spindle is rigidly mounted in a combination of ball bearings and needle bearings to provide maximum radial and thrust support. The exceptionally smooth finish obtained with this tool is attributed to the method of mounting the spindle. Cutters such as spot-facers and countersinks, or a combination of both, are available for a wide variety of applications. The tool can be mounted in any standard drill press. It is regularly made in sizes to accommodate cutters up to 3 inches in diameter, but can be specially made to accommodate cutters of larger sizes.....77



Edlund Spot-facer with Offset Head

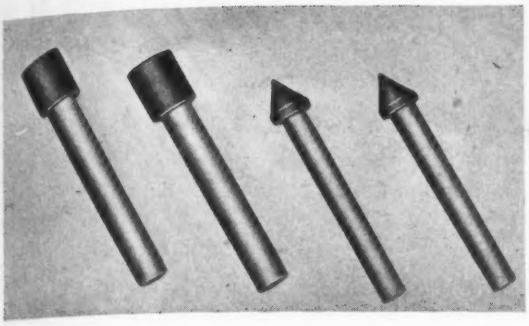
Improved "Di-Acro" Shear

An improved No. 3 shear has recently been added to the line of "Di-Acro" die-less duplicating hand-operated bench shears made by the O'Neil-Irwin Mfg. Co., 332 Eighth Ave. S., Minneapolis 15, Minn. Both shear blades of this tool are fully adjustable for tolerances in shearing, as well as for control of angularity of pitch, which can be quickly varied as desired for shearing all types of metals within its capacity, ranging from heavy steel sheet and spring tempered materials down to the lightest of fabrics and tissues.

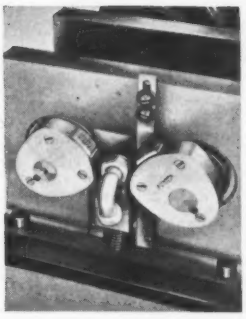
Precision adjustment for accurately stopping the blade travel permits the shear to be easily set for a large variety of accurate slitting and notching operations. A metal stripping guide, which moves with the shear blade, can be employed for stripping all types of materials. A chute built into the unit delivers all materials, including fabrics and tissues, at any speed at which the press can be operated. The heavy tool steel shear blades, properly hardened, tempered, and ground, are reversible and readily adjustable to compensate for wear.

All main bearings are adjustable for wear and alignment. The upper bearings are provided with oil-cups, and are rifle-drilled to provide lubrication for the lower bearings. Automatic spring action facilitates faster operation. The shear has a capacity for shearing 18-gage steel plate (0.048 inch) up to 12 inches wide. Other metals and materials of heavier gage, in proportional widths and thicknesses, can also be sheared. The shear weighs 150 pounds. 78

To obtain additional information on equipment described on this page, see lower part of page 192.



Champion Tungsten-diamond Metal-finishing Burrs and Wheels



Machine for Marking Hexagonal Nuts

Tungsten-Diamond Burrs and Wheels

The Champion Diamond Co., 551 Fifth Ave., New York 17, N. Y., has just developed a line of metal-finishing burrs and wheels made of a mixture of tungsten powder and diamond grit. The special tungsten alloy used for these new products is impregnated with diamond powder and formed into round and cone-shaped wheels.

These wheels and burrs are especially adapted for use in precision surfacing and final finishing operations. They are particularly well suited for finishing tungsten steel dies and parts made from other materials that are difficult to machine with ordinary burrs. The burrs and wheels are made in sizes from 1/8 to 1 inch in diameter.....79

Boyar-Schultz Tool Adapter for Screw Machine

The Boyar-Schultz Corporation, Walnut St. at Hoyne, Chicago 12, Ill., has just brought out a new Model H tool adapter that is designed to double the capacity of screw machines. This adapter permits the use of more than one size tool in any single machine, is precision made throughout, and is hardened and ground to assure an accurate fit. At present, it is made in four sizes—5/8 to 3/4 inch short, 5/8 to 3/4 inch long, 5/8 to 1 inch, and 3/4 to 1 inch.....80

Machine for Marking Two Sides of Hexagonal Nuts Simultaneously

The Acromark Co., 9-11 Morrell St., Elizabeth 4, N. J., has brought out a machine with double marking rolls or dies, designed to mark two sides of hexagonal nuts simultaneously as fast as the nuts can be fed into the machine. The marking is accomplished by the rolling action of the dies, rather than by a stamping action, to minimize deformation and eliminate the crushing effect. The marking dies are so constructed as to compensate for differences in the amount of lettering on each die, thus maintaining a uniform depth of marking on both sides of the work. The rolls are completely guarded during operation, yet they are easily accessible for inspection or changing. The marking depth is controlled by a wedge type lock.

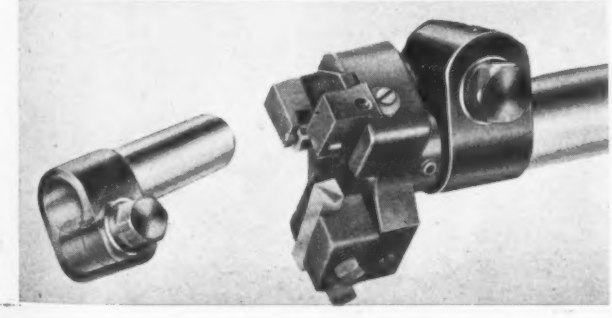
In operation, the nut is placed in position on a small V-block set on slides located between the two marking rolls. The operating lever is engaged, causing the marking rolls to turn toward each other and engage the initial part of each marking die with the lower sections of the opposite faces of the nut. As marking proceeds, the holder slides down allowing the marks to be progressively rolled into the sides of the nut.

The machine illustrated is built to mark nuts on the end of an assembled cable, but with slight changes it can be adapted for handling loose nuts fed from a chute. When the nuts are fed by hand, production averages thirty marked parts per minute. The unit is driven by a 1/2-H.P. gear reduction motor. 81

Reliance Electronic Speed Programmer

A system of program control that operates electronically and is unaffected by temperature has been developed by the Reliance Electric & Engineering Co., 1088 Ivanhoe Road, Cleveland, Ohio. Any number of speeds desired, covering the entire range of the unit to which it is applied, can be scheduled for automatic functioning. By setting a series of dials, the desired speeds are reproduced accurately and independently of each other. The rate of change from one operating speed to another is controllable, and can be made with great rapidity. Speed selections can be handled with either limit switches or other similar devices for opening and closing circuits.

This unit, in effect, is a simple electronic grid-controlled rectifier, arranged for the conventional control, using a fixed displaced alternating-current rider voltage in the



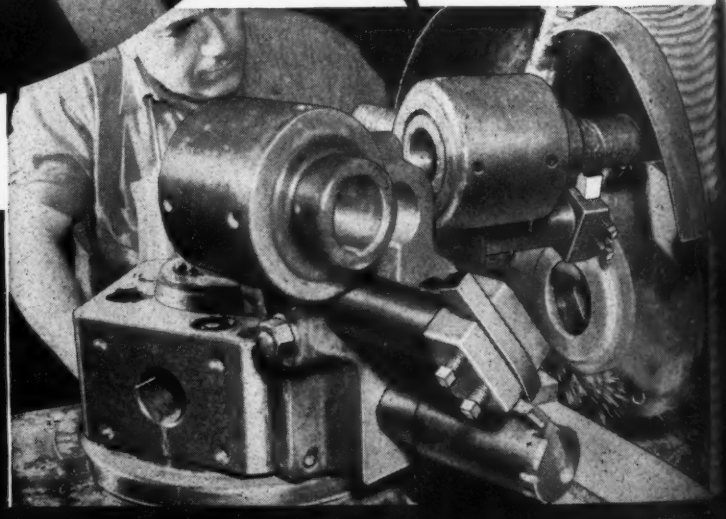
Tool Adapter for Screw Machine Made by Boyar-Schultz Corporation

Electronic Speed Programmer Developed by Reliance Electric & Engineering Co.

To obtain additional information on equipment described on this page, see lower part of page 192.

'STANDARDS' are "TOPS" for

AVAILABLE FROM STOCK
IN 10 STYLES—5 GRADES
AND ALL COMMON SIZ



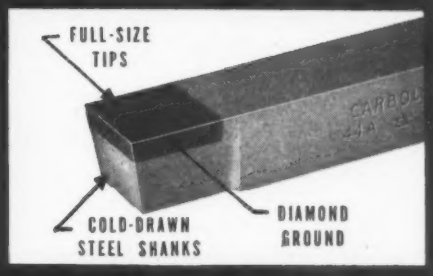
...chining time reduced, tool life increased, hand polishing time cut 80%, on this steel aircraft gear. Typical of the many benefits of standard Carboloy Tool use.

60 -80 of Your TURNING BORING, FACING

USE OF Standard Carboloy Tools has swiftly spread since their introduction until today practically every major war plant machining metals now uses "standards" to step up production and step down costs. Here's why:

Standard Carboloy Tools are top quality carbide tools at prices generally comparable to other cutting materials. Designed in 10 standard styles adaptable to 60% to 80% of all single point turning, facing and boring work. When required, these "standards" can be quickly ground to many special shapes and put on the job *fast*. Eliminates need for large, complicated stocks of "specials". Permits minimum tool inventories. Simplifies handling and ordering. Can be converted readily to peacetime production.

Specify *Standard* Carboloy Tools for top performance, top economy. 10 styles, 5 grades, wide range of sizes—for cutting steel, cast iron, non-ferrous and non-metallics. In stock for prompt delivery. Write for new catalog GT-175.



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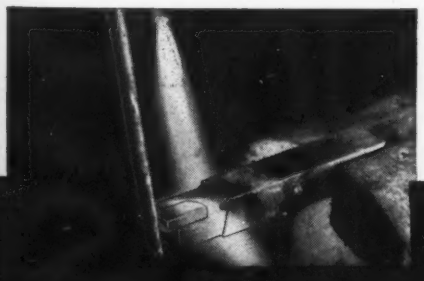
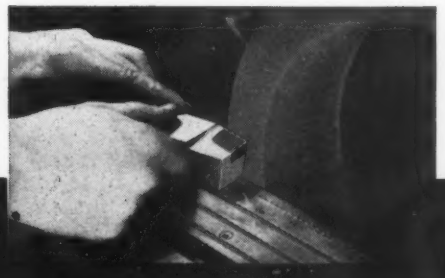
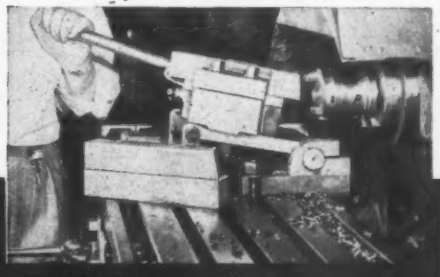
"Tops" in Convenience! With "standards", the bulk of your requirements can be met from just 10 styles. Simplified stocks. Easy to maintain.







CARBOLOY

TRADEMARK

control grid circuit. This alternating-current grid voltage is superimposed on a direct-current voltage which represents the sum of an adjustable positive voltage and a feedback negative voltage from the generator armature of the driving motor. When running at a steady speed, a balance of control voltages is established which maintains the required voltage output from the generator. Although this control can be applied to all types of adjustable voltage drives, it is especially adapted for applications requiring a series of adjustable pre-set speeds with automatic or manual selection of these speeds.—82

American "Speed-Jack"

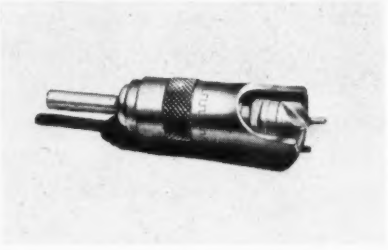
Simplified remote control and universal mounting are features of a new and radically different variable-speed transmission developed recently by the American Pulley Co., 4200 Wissahickon Ave., Philadelphia 29, Pa., for drives up to 1 H.P. Remote control is easily accomplished with this drive by means of a compact flexible shaft. With this arrangement, the unit can be mounted anywhere in or on the machine and the control installed in a safe, convenient position.

This simplified, remote control is intended to broaden the field of application for the "Speed-Jack" and to facilitate installation on a wide variety of machines. It can be mounted either vertically, horizontally, or in any other position to suit requirements. Stepless control of the speed is obtained through a 3 to 1 ratio.

This variable-speed transmission is particularly adapted for use on band saws, conveyors, drills, emboss machines, etching machines, internal grinders, lapping machines, lathes, and milling machines.—83

Countersink with Micro-Set Stop

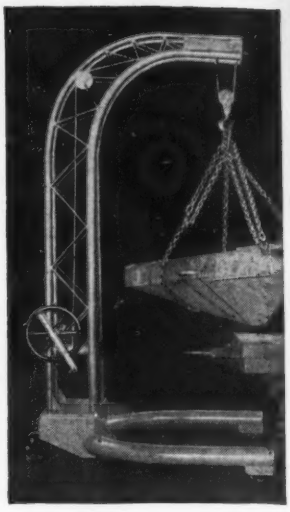
A micro-set stop countersink with a cutaway skirt designed to permit countersinking in corners, next to joints, etc., is being made by Aircraft Tools, Inc., 750 E. Gage, Los Angeles 1, Calif. Light weight and compactness are features of this new countersink, which is designated Model 400-A. It has a split collet type shaft which permits using various cutters and pilots, and a full ball thrust bearing to eliminate heat and friction. The stop-collar is adjustable in increments of 0.002 inch, and can be positively locked in place.—84



Countersink with Micro-set Stop Made by Aircraft Tools, Inc.

Canton Portable Cranes

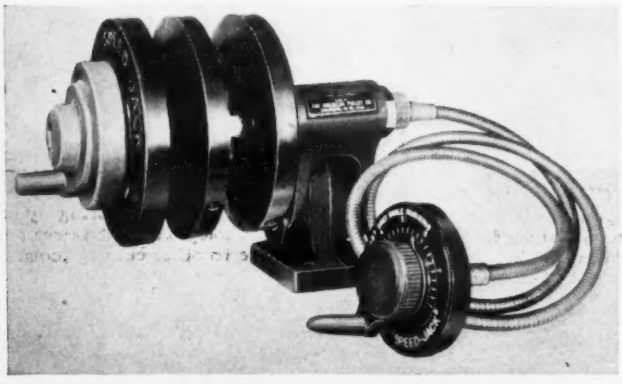
A line of improved Canton portable cranes for handling loads where overhead lifting equipment is not available has been placed on the market by the Hill Acme Co., 6400 Breakwater Ave., Cleveland, Ohio. These portable cranes are made of welded steel, and weigh less than half as much as previous models. Two-speed operation to suit light or heavy loads is provided by a single or a double cable. The extension handle can be adjusted to give the leverage required for lifting heavy loads. A self-locking worm mechanism holds the load at any desired height. This crane is available in various models having capacities ranging from 1 to 3 tons.—85



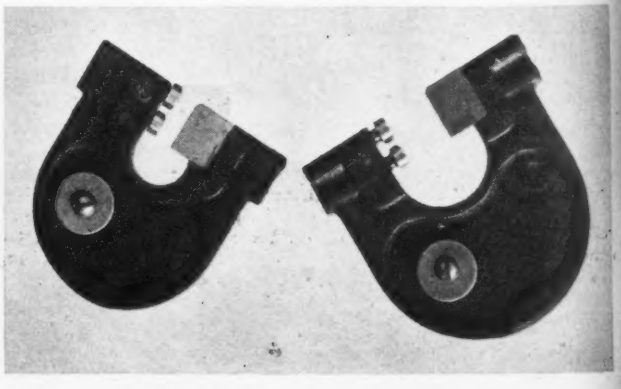
Canton Portable Crane

Atlantic Adjustable Limit Gages

The George Scherr Co., Inc., 400 Broome St., New York 12, N. Y., has announced the addition of four midget type gages to its line of adjustable limit snap gages. These



"Speed-Jack" Variable-speed Transmission with Remote Control



Atlantic Midget Type Adjustable Limit Snap Gages

To obtain additional information on equipment described on this page, see lower part of page 192.

12 Plus Pieces IN EVERY TOOL GRIND

SUNOCO
EMULSIFYING CUTTING OIL

Saves Time . . . Ups Production . . . By Boosting Tool Life 33%

More production . . . less interruption — that's the goal of practically every machine shop in the country today. And here's how one large shop achieved it by getting 12 plus pieces per tool grind.

Tool life was short in relation to their production quota of vitally needed parts for mechanized fighting equipment. "Downtime" for regrinding and resetting tools meant lost production time. So they asked a Sun Oil Engineer what he could do about it. After a careful study he recommended a change in cutting oil . . . to Sunoco Emulsifying Cutting Oil . . . and suggested they run a test to prove Sunoco's merit.

Test showed 33% greater tool life with Sunoco. They were able to machine an average of 47 pieces per grind as against only 35 with the previous oil. Less interruptions for regrinding . . . more production. So Sunoco was adopted for all operations requiring a soluble cutting oil.

Your plant can profit, too, from the advantages of Sunoco Emulsifying Cutting Oil. The exceptional heat-absorbing and rust-preventing characteristics of Sunoco are responsible for its almost universal use where closest tolerances, finest finishes, speed of production and economy are required. Let Sunoco help you pack every man-hour and machine-hour with peak production. Write . . .

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gages are manufactured in accordance with the American Gage Design Standards, and are adapted for checking and inspecting extremely small and delicate parts. These midget gages can be set to measure dimensions from 0.000 to 0.760 inch. 86

Scherr "Opti-Flat"

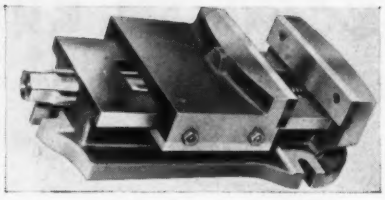
The "Opti-Flat" shown in the illustration is the latest addition to the line of precision inspection equipment placed on the market by the George Scherr Co., Inc., 400 Broome St., New York 12, N. Y. This is a highly accurate, optically polished, glass master surface plate, flat to an accuracy of fifty millionths of an inch. It is extremely resistant to abrasion. The 12-inch

"Opti-Flat" Polished Glass Surface Plate

diameter size is 2 inches thick, and the 16-inch diameter size is 3 inches thick. These flats are inspected by means of master optical flats by light interference methods which enable the operator to check flatness accuracy within millionths of an inch. 87

Rousselle Stationary Vises

Four new heavy stationary vises have been added to the Rousselle Victory line of the David J. Ross Co., Benton Harbor, Mich. Like the swivel-base vise previously brought out by this company, the new stationary vise is made in 4 1/2-, 7-, 10-, and 13-inch sizes.



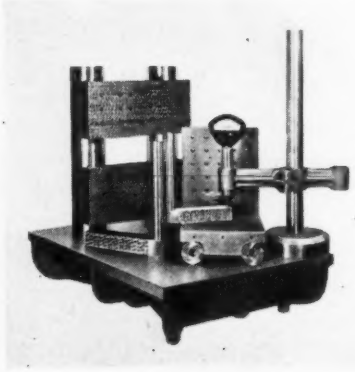
Rousselle Vise Made in Four Sizes

Extra heavy bases, ways, and locking screws are employed to meet the requirements for machining heavy precision work. A clean-out opening in the base jaw permits easy removal of chips. 88

Thomas Inspection Equipment for Tool-Rooms

Inspection equipment consisting of three units has been brought out by the Thomas Tool & Machine Co., 66 N. Park St., Pontiac, Mich., for use in the shop and tool-room. The equipment provides for an extremely wide range of angle checking. The 7- by 12- by 12-inch sine angle square unit can be used for right- and left-hand horizontal angular measurements up to 75 degrees. The second unit consists of a heavy type surface plate with hardened and ground cylindrical posts and cross-plates. The plates are hollow and ventilated to balance inner and outer temperatures.

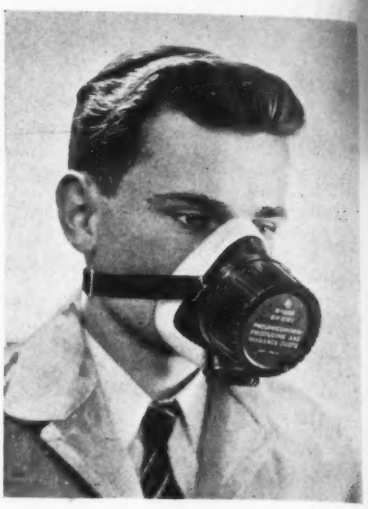
The third unit is a utility try-square, made in sizes from 4 to 16 inches. This try-square has solid cylindrical posts which can be used in making inside and outside measurements. The steel used in all three instruments is aged, heat-treated, and tested to 60-64 Rockwell C hardness. 89



Thomas Tool-room Inspection Equipment

Facelets for Industrial Respirators

The R-1000 respirator developed by the American Optical Co., Southbridge, Mass., to protect workers against certain dust, fume, and gas hazards, is now being equipped with knitted cotton facelets, as



Respirator Equipped with Knitted Cotton Facelet Made by American Optical Co.

shown in the accompanying illustration. These facelets, designated "AO," are soft, absorb perspiration, and protect the wearer's face against dust and dirt. They help to prevent skin irritation, and eliminate the necessity for using protective creams to avoid face chapping. 90

Electrode for Arc-Welding Aluminum

An electrode with a new coating designed to facilitate the metallic arc-welding of aluminum sheet material and castings has just been placed on the market by the Eutectic Welding Alloys Co., 40 Worth St., New York 13, N. Y. This new rod, known as "EutecTrode 2100," is especially adapted for use in salvaging and reclaiming aluminum castings. It is a high-aluminum, low-silicon composition rod which alloys readily with aluminum, and is available in 1/8-, 5/32- and 3/16-inch sizes. It is possible with this electrode to add metal without completely preheating the casting and without danger of overheating the metal adjacent to the weld. 91

To obtain additional information on equipment described on this page, see lower part of page 192.

Q. What is the range of speed variation?

A. REEVES units are available in speed variations from 2:1 to 16:1 ratios inclusive, although most installations require no more than a 4:1 range. Actual driven speeds can be secured, through reduction or increase, to provide as low as fractional r.p.m. or as high as 12,000 r.p.m.

Q. What horse power capacities?

A. Sizes from ¼ to 90 h.p.

Q. How about transmission of power—is it positive at all speeds?

A. There are countless installations of REEVES units where the slightest amount of slippage would invalidate all benefits—such as on cut-off saws, rayon spinning, etc. The answer is yes—the transmission of power is absolutely positive at all speeds.

Q. What are the torque characteristics?

A. Constant torque; power transmitted is proportionate to speed. REEVES units do not drop off sharply in h.p. at any low speeds. Constant h.p. with variable torque rated units also available.

Q. How about remote control? Operator is often at considerable distance from the drive.

A. REEVES Electric Remote Control is available with one or more push button stations, which can be located at any convenient place.

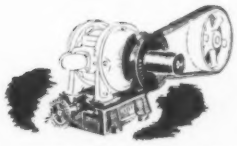
Q. Can speeds be changed automatically?

A. Yes. Actuation for automatic control can be taken from many sources, depending on material being processed. REEVES Hydraulic Automatic Control is especially suited to wide applications, being highly sensitive to change in controlled material. Pressure of only 2 or 3 ounces will produce desired changes in speed. Mechanical and differential also available. All are based on REEVES broad experience in installing automatic variable speed control.

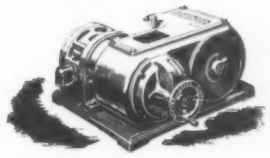
Q. Are the units easy to service?

A. Here's what one user says: "Anybody with a wrench and screw-driver can keep a REEVES Transmission running." And this user has 3 units that have been operating in his plant since 1904.

VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed flexibility over wide range. Send for Catalog T-443.



VARI-SPEED MOTOR PULLEY converts any standard constant speed motor to a variable speed drive. Send for Catalog V-440.



MOTODRIVE combines motor, speed varying mechanism and reduction gears in single compact unit. Send for Catalog M-441.

• More complete information, including h.p. ratings, speed ranges, dimension tables and full description of each Basic Unit in REEVES line—is yours for the asking. Note catalogs offered above.

REEVES PULLEY COMPANY • DEPT. M • COLUMBUS, INDIANA

REEVES *Accurate Variable* SPEED CONTROL

Nitriding High-Speed Steel Tools

IN a paper on the nitriding of hardened high-speed steel tools, read before the spring meeting of the American Society of Mechanical Engineers at Birmingham, Ala., J. G. Morrison, metallurgist of the Landis Machine Co., Waynesboro, Pa., covered both the metallurgical and the practical application aspects of nitriding. An abstract of that part of the paper dealing with applications is given in the following.

The author stated that it is sometimes difficult to predict what improvement nitriding may confer upon a particular tool until this has been ascertained experimentally, except that, in general, it is of definite value for tools that take relatively light cuts and that are not subjected to a great deal of shock. Sometimes nitriding may be used as a corrective after faulty grinding—that is, in those cases where the surface has been slightly softened (but not ruined) in grinding. In that case, nitriding may restore the surface hardness and greatly prolong tool life.

Tools to which Nitriding is Most Advantageously Applied

High-speed steel taps are often improved by nitriding. However, if the taps have had a short life because of misalignment, nitriding may aggravate rather than improve the condition. Sometimes taps may not be sufficiently hard or may have had the thread damaged in grinding. In such cases, nitriding generally improves the performance to a remarkable degree.

Nitriding is applied to a considerable extent to twist drills. On twist drills, the nitrided surface, after sharpening, is on the cutting face (or in the spiral flutes), whereas on a tap, after sharpening, the nitrided surfaces are on the clearance faces. It is believed desirable in fine-edged tools to have the nitrided surface on only one face area, in order to minimize edge brittleness.

On single-point tools used in threading or forming, where accurate size and good finish are required, nitriding for from thirty minutes to one hour may improve the tool life considerably. In such cases, size and finish are the desired results rather than the ability of the tool to remove metal.

The author stated that in his experience milling cutters and shaper tools had not proved to be greatly benefited by nitriding, possibly because of the impact under which these tools work. Some nitrided milling cutters, however, used on soft free-cutting materials, or on soft but abrasive materials, have, at times, doubled or tripled the production.

Application to a Square Thread Hob

In one case, a small four-fluted threading hob, about 5/8 inch in diameter, was used for hobbing a part with 8 square threads per inch in 18-4-1 high-speed steel. The metal removed by each hob tooth was from 0.0015 to 0.0025 inch. In the past, carbon tool steel hobs were used for this work, since almost perfect sharpness of the edge of the tool was required in order to obtain as nearly a perfect square thread as possible. The average performance, using carbon tool steel hobs, was 15 pieces, 3 inches in length, before the tools required regrinding, and the highest production for any one grinding was 25 pieces.

Molybdenum high-speed steel hobs, properly heat-treated, produced only two or three pieces before regrinding was necessary. However, when the molybdenum high-speed steel hobs were nitrided at 1050 degrees F. for twenty minutes, the average production per grind was 27 pieces. Then several hobs were nitrided at 1050 degrees F. for one hour. These hobs produced, on an average, 73 pieces per grind. This is a rather special case, but for the difficult operation of cutting a good square thread these nitrided tools proved very satisfactory.

When heavy wear is encountered in addition to frictional heat as, for example, in the case of heavy-duty lathe centers made of high-speed steel, nitriding for 1 1/2 hours at 1050 degrees F. increases the life from three to four times. Another example of greatly prolonged life is found in gages and gaging fixtures made of nitrided high-speed steel.

In summarizing his conclusions, the author said that nitriding of hardened high-speed steel tools by means of molten cyanide baths at a temperature of about 1050 degrees F. appears to have its greatest usefulness when applied to tools that take relatively light cuts without heavy impact. Gas nitriding of high-speed steel tools, he said, has not proved successful. This is probably due to the excessive amount of nitrogen usually absorbed, which results in a brittle case.

To obtain good results consistently, proper control of the nitriding bath as regards temperature and composition is necessary.

Parts made of high-speed steel that are required to have resistance to wear and heat, such as heavy-duty lathe centers and gages, are greatly improved by nitriding as regards the length of their useful life.

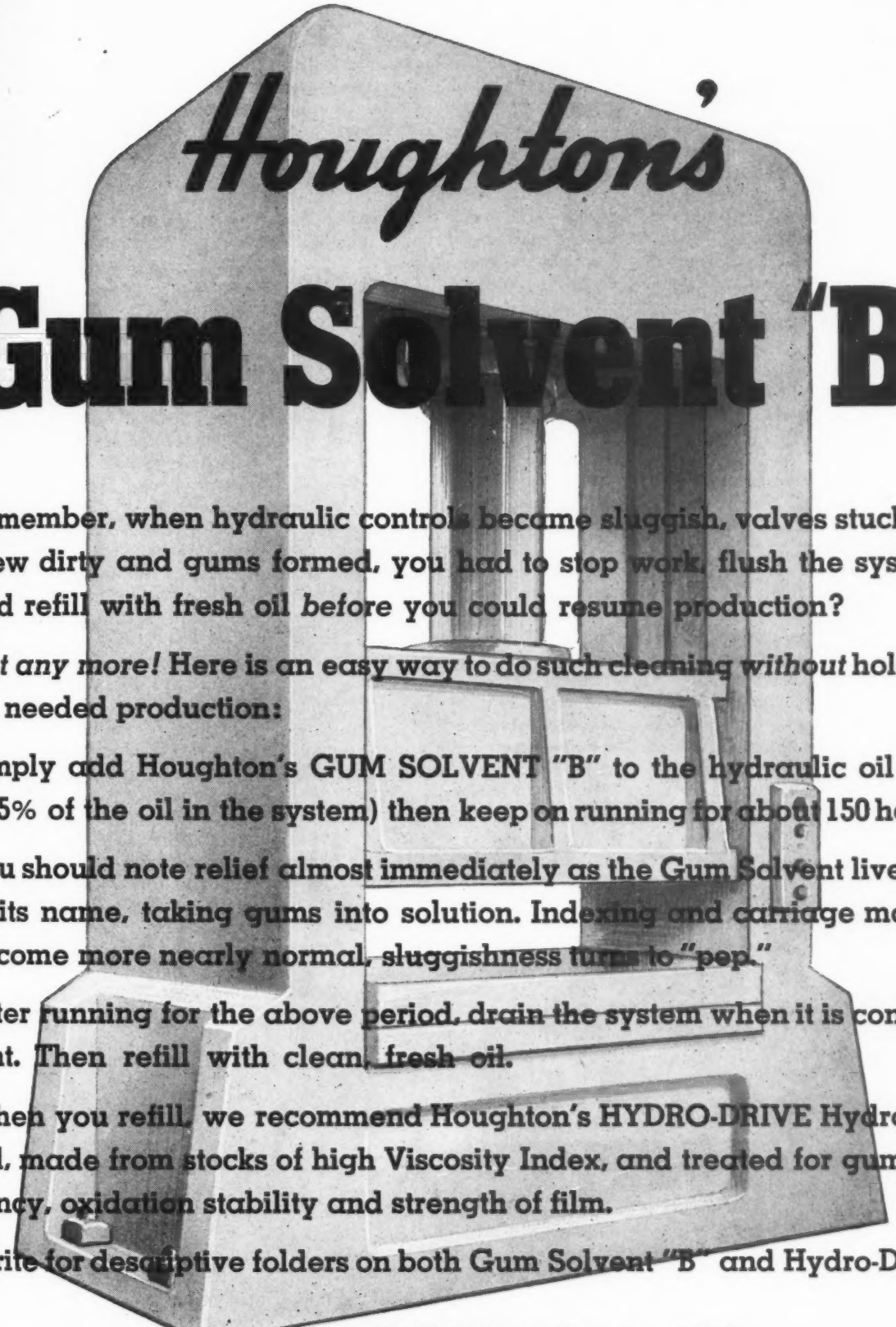
Liquid nitriding of high-speed steel tools has been in commercial use for about ten years. During this period, there has been a considerable increase in the application of this treatment. It is believed that the future will show a continued and extended use of the process to high-speed steel tools for which it is adapted.

* * *

War Contract Termination Procedure

A booklet entitled "How One Company Organized to Handle War Contract Terminations" has been published by Lyon Metal Products, Inc., Aurora, Ill. This booklet gives directions that are not based on theory, but that have been applied in actual practice in the handling of hundreds of war contract terminations. Lyon Metal Products, Inc., offers this book free to any manufacturer who wishes to obtain it, having presented this book to the war equipment contractors as a war service. The publication of the book was suggested after it had been examined by the Chicago Ordnance Office, the Army authorities in Washington, and the National Association of Manufacturers. It is a step-by-step graphic presentation of a most difficult and complicated subject.

For cleaning hydraulic systems without stopping production



Houghton's Gum Solvent "B"

Remember, when hydraulic controls became sluggish, valves stuck, oil grew dirty and gums formed, you had to stop work, flush the system, and refill with fresh oil *before* you could resume production?

Not any more! Here is an easy way to do such cleaning *without* holding up needed production:

Simply add Houghton's GUM SOLVENT "B" to the hydraulic oil (3% to 5% of the oil in the system) then keep on running for about 150 hours.

You should note relief almost immediately as the Gum Solvent lives up to its name, taking gums into solution. Indexing and carriage motion become more nearly normal, sluggishness turns to "pep."

After running for the above period, drain the system when it is convenient. Then refill with clean, fresh oil.

When you refill, we recommend Houghton's HYDRO-DRIVE Hydraulic Oil, made from stocks of high Viscosity Index, and treated for gum solvency, oxidation stability and strength of film.

Write for descriptive folders on both Gum Solvent "B" and Hydro-Drive.

E. F. HOUGHTON & CO.
PHILADELPHIA 33, PA.

CHICAGO DETROIT SAN FRANCISCO

A Safety Color Code for Industry

A SAFETY color code for industry has been devised by E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del., the object of which is to make effective a uniform system of color safety indications for industry. Under this system, certain standard colors are used to indicate accident hazards, to identify protective equipment, and to insure orderly factory arrangement and good industrial housekeeping.

There is today no uniform practice in industry for the use of color for safety. While in many plants color is used freely, its use is haphazard. Color has been universally applied in railroad and traffic signal codes, but it has not been used in any uniform manner to promote everyday industrial safety.

To make the most effective use of color for safety, the following points are emphasized: Color in a safety program should attract the worker's attention and should be associated in his mind with specific predetermined conceptions. Commonly recognized colors must be used, each of which can be readily identified by name. Furthermore, any identification based on color must consider previous usage. The association of red with fire protection and of green with safety is traditional. The factor of high visibility under all lighting conditions must also be recognized, as well as the frequency of color blindness. To meet this condition, symbols are used to represent each color.

Six colors are recommended as basic for a general industrial safety color code. These are: Yellow, orange, green, red, blue, and white. Black or gray may be substituted for white. To each color has been assigned an easily recognizable symbol. As applied to industry, each color or its symbol can be used to indicate a distinct type of hazard or to establish some specific identification.

A high visibility yellow is used to warn against hazards that may involve stumbling, falling, tripping, or obstructions that may prove dangerous to those passing through the plant. Sometimes a solid band of yellow will be sufficient; but where strong attention value is necessary, the code symbol, parallel bars of yellow and black, should be used. Color experts agree that black on yellow has the highest visibility of all color combinations. This safety color, for example, would be applied on trucking equipment, protruding parts, aisle markings where danger is to be warned against, curbings, edges of loading platforms and pits, dead ends, low beams, railings, stairway approaches, floor-pan edges, changes in floor elevation, conveyors at dangerous levels, chain hoist blocks, loading buckets, obstructions in aisles, etc.

Orange is used to indicate dangerous parts of machines or equipment that might cut, crush, or otherwise injure a worker. If machine guards can be opened or are removable, the inside part should be painted with orange to immediately attract attention to the fact that the dangerous parts are unguarded and exposed. The symbol used is an equilateral triangle. This color would be applied to the interior surfaces of electrical switch boxes, fuse boxes, machinery guards, and to exposed pulleys, gears, cutting devices, etc.

Green should be used to paint first-aid cabinets, for the quick location of bandages and medicines, and other medical equipment. The symbol, which is a green cross, should be placed on walls above such equipment so that it can be seen readily from a distance. This restricted use of green will have value in acquainting the worker with the location of safety devices in the plant, and will be of great value in time of emergencies.

For many years, red has served to identify fire protection equipment. This use is firmly established and hence, red has been adopted in the safety color code for this purpose. Industry should not employ red to signify danger, primarily because of its low visibility, compared with yellow or orange. Fire protection red has a major duty—to locate and indicate the means for combating fire danger and assuring safety from fire. Red squares on walls, and on the floor, and red bands on fire protection pipes indicate locations of equipment.

Blue has been used for many years to indicate caution. Blue signs or blue lanterns have been used by the railways to indicate a train or car which is being worked on. The blue symbol is a circle, and the chief function of this symbol is to caution against operation of equipment that may be under repair or that should not be moved or started. The blue circle should be hung over such devices so that it is clearly seen, and employes should be instructed accordingly. Blue may also be painted on switch control boxes and on starting and stopping levers as a constant reminder to the employes to observe caution and to insure that the equipment is free from danger to themselves and others.

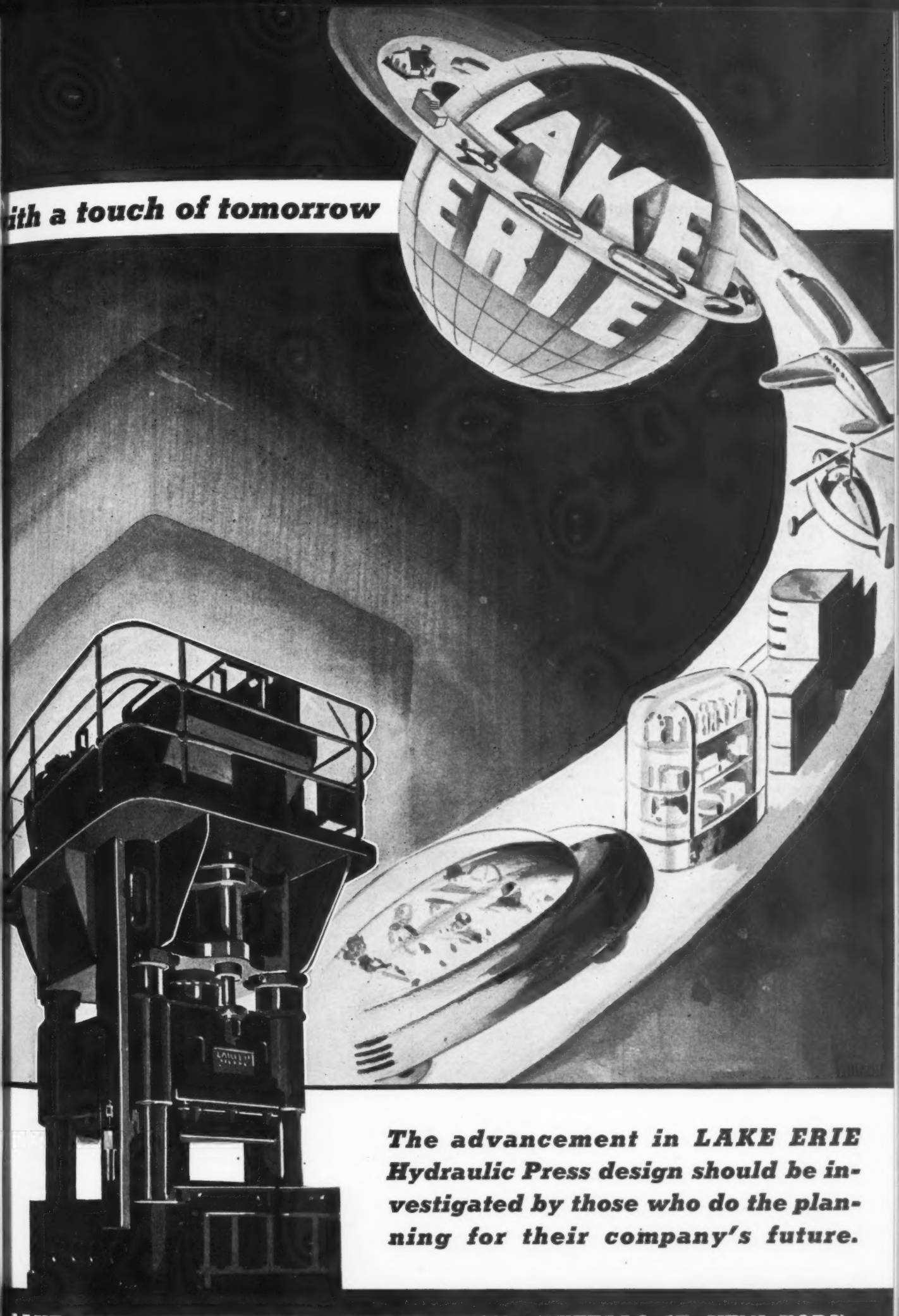
White in the safety color code marks aisles, storage spaces, or rubbish containers. The rule is to use white on dark floors, but black on light floors. If the aisle marking next to a dangerous object, yellow is the better color to use. Gray is a practical color for waste receptacles, although white emphasizes cleanliness or neatness. Painting corners white encourages good housekeeping. Painting the wall and floor areas adjacent to waste receptacles discourages littering. The symbol for this paint is a five-pointed star painted on the wall above receptacles.

The use of colors and symbols for piping identification should also be considered part of a safety color code for industry. In identifying piping, red signifies fire protection equipment (sprinkler systems); yellow or orange indicates dangerous materials (acids, gases, steam, etc.); green (or white, black, gray or aluminum), safe materials (drinking water, brines, compressed air, etc.)

* * *

Industrial Furnaces

An informative bulletin entitled "Industrial Furnaces and Industrial Ovens—an Industry Report" has been published by the Industrial Furnace Manufacturers Association, Inc., 420 Lexington Ave., New York 17, N. Y. This report deals with the industrial furnace industry's position under the present tax and renegotiation laws. The situation described is of interest to the business community at large, since many other lines of industry are in practically the same position.



The advancement in LAKE ERIE Hydraulic Press design should be investigated by those who do the planning for their company's future.

LAKE ERIE ENGINEERING CORPORATION • BUFFALO 17, NEW YORK

News of the Industry

California and Washington

ALVIN ZWERNEMAN has been promoted to the position of vice-president and general sales manager of the Axelson Mfg. Co., Los Angeles, Calif., manufacturer of oil-well equipment and machine tools. Mr. Zwerneman has just returned from Washington where, for nine months, he has been affiliated with the Petroleum Administration for War. He served as assistant to the director in the Materiel Division of the PAW. Previous to his service in Washington, he had been connected for twenty years with the Axelson Mfg. Co.

ALMQUIST BROTHERS & VIETS, distributors in Los Angeles for the Abrasive Co., Philadelphia, Pa., have expanded their facilities by adding an abrasive warehouse covering 2000 square feet. This building will be used for storing complete stocks of grinding wheels, mounted points, abrasive cloth and belts, coated abrasives, and sharpening stones.

WALLACE JOHNSON was recently appointed general sales manager of the Joshua Hendy Iron Works, Sunnyvale, Calif.

LINK-BELT CO., Chicago, Ill., announces the opening of a sales office and warehouse at S. 151 Lincoln St., Spokane, Wash. HOMER A. GARLAND, who has been associated with the Link-Belt organization since 1922, is in charge of the new office.

Arthur J. Miller, President and General Manager of the Chicago Wheel & Mfg. Co.

Illinois

ARTHUR J. MILLER has been elected president and general manager of the Chicago Wheel & Mfg. Co., Chicago, Ill., manufacturer of mounted wheels, grinding wheels, and allied abrasive products. Mr. Miller replaces his father, Henry E. Miller, founder of the company, who passed away last January. In 1915, A. J. Miller joined the company in the special formula department, and has been continuously associated with the production of abrasive products since that time. In 1926, he was elected treasurer in charge of manufacturing operations. Many of the developments of the company were engineered by Mr. Miller, including the first high-speed lightweight portable electric grinder, industrial mounted wheels, and a variety of bonding processes now generally adopted throughout the abrasive industry. IRVING DANIELSON, will be associated with Mr. Miller as vice-president in charge of purchases. A. J. MILLER, JR., is treasurer in charge of engineering developments, and ARTHUR T. DALTON has been appointed secretary and sales manager.

HAROLD B. RESSLER, vice-president of Joseph T. Ryerson & Son, Inc., Chicago, Ill., who has been located in the New York plant of the company, will move to the executive offices in Chicago, where he will be in general charge of sales in all territories.

Harold B. Ressler, Vice-president of Joseph T. Ryerson & Son, who is Now in Charge of Sales in All Territories

AINSLIE Y. SAWYER, assistant to the president, has been elected vice-president and will continue in general charge of purchases, with headquarters at Chicago. HARRY W. TRELEAVEN, assistant manager of the Ryerson New York plant (located in Jersey City), has been appointed manager of that plant. THOMAS Z. HAYWARD has been made assistant general manager of sales.

EDWARD N. HAAS has been appointed works manager of the Aurora, Ill., plant of the Independent Pneumatic Tool Co., Chicago 6, Ill., succeeding W. H. BREWER, who has been made general factory manager. JOHN P. BANK succeeds Mr. Haas as assistant works manager.

RED-E-AIR CHUCK CO., 601 W. Washington Blvd., Chicago 6, Ill., has changed the firm name to REDMER AIR DEVICES CORPORATION.

Michigan

ALBERT J. PRANCE, president of the Murchey Machine & Tool Co., Detroit 26, Mich., and general manager since the incorporation of the company in 1912, has been forced to free himself of direct management responsibility for reasons of health. He will continue as president and as a director of the company. W. C. BUECHNER, who has been connected with the company for about twenty-six years, has resigned as sales manager with a view

Ainslie Y. Sawyer, Newly Elected Vice-president of Joseph T. Ryerson & Son, Who is in General Charge of Purchases

MACHINERY'S DATA SHEETS 515 and 516

COMMON WELDING TROUBLES—CAUSES AND CURES. 1

Trouble	Cause	Cure
Distortion	(1) Shrinkage of deposited metal draws parts together, changing their relative positions. (2) Non-uniform heating causes distortion of parts while welding. Final welding of parts in the distorted position prevents maintenance of proper dimensions. (3) Improper welding sequence.	(A) Properly clamp or tack-weld parts to resist shrinkage. (B) Pre-form parts to compensate for shrinkage during welding. (C) Distribute or arrange welding to prevent excessive local heating. Preheat heavy structures when advantageous to do so. (D) Removal of rolling or forming strains before welding is sometimes helpful. (E) Study structure and develop definite welding sequence.
Warping (Thin Plates)	(1) Shrinkage of deposited weld metal. (2) Excessive local heating at the joint. (3) Improper preparation of joint. (4) Improper clamping of parts.	(A) Select electrode with high welding speed and moderate penetrating properties. (B) Weld rapidly to prevent excessive local heating of plates adjacent to weld. (C) Do not have excessive spaces between parts to be welded. (D) Properly clamp parts adjacent to joint. Use back-up to cool parts rapidly. (E) Use special welding sequence; step back or skip procedure. (F) Peen joint edges slightly before welding. This elongates edges, and the weld shrinkage causes them to pull back to the original shape.
Welding Stresses	(1) Joints too rigid. (2) Improper welding sequence. (3) Inherent in all welds, especially in heavy parts.	(A) Slight movement of parts during welding will reduce welding stresses. (B) Make weld in as few passes as practical. (C) Peen each deposit of weld metal. (D) Anneal finished product at 1100-1200 degrees F. for one hour per inch of thickness. (E) Develop welding procedure that permits all parts to be free to move as long as possible.

MACHINERY'S Data Sheet No. 515, June, 1944

Compiled by C. H. Jennings, Welding Engineer
Westinghouse Electric & Mfg. Co.

COMMON WELDING TROUBLES—CAUSES AND CURES. 2

Trouble	Cause	Cure
Spatter	(1) Property of some electrodes. (2) Excessive welding current for the type or diameter of electrode used. (3) Excessively long arc. (4) Arc blow.	(A) Select proper type of electrode. (B) Do not use excessive welding current. (C) Hold proper arc length. (D) Reduce arc blow. (E) Paint parts adjacent to weld with whitewash. This prevents spalls from being welded to parts and makes removal easy.
Under-cut	(1) Excessive welding current. (2) Improper manipulation of electrode. (3) Attempting to weld in a position for which the electrode is not designed.	(A) Use moderate welding current and avoid too rapid travel or welding rate. (B) Be sure electrode is not too large for work. If the puddle of molten metal becomes too large, under-cut may result. (C) Avoid excessive weaving which will cause under-cut. (D) A uniform weave will aid in preventing under-cut in butt welds. (E) Do not hold electrode too near the vertical plane when making a horizontal fillet weld, as under-cutting on the vertical plate may result.
Cracked Welds	(1) Joint too rigid. (2) Welds too small for size of parts joined. (3) Poor welds. (4) Improper preparation of joints. (5) Improper electrode.	(A) Redesign the structure and develop a welding procedure to eliminate rigid joints. (B) Do not use too small a weld between heavy plates. Increase size of welds. (C) Do not make welds in string beads. Make weld full size in short section, 8 to 10 inches long. (D) Welding sequence should be such as to leave ends free to move as long as possible. (E) Be sure that welds are sound and that fusion is good. (F) Preheating parts to be welded is sometimes helpful. (G) Prepare joints with a uniform and proper free space. In some cases, a free space is essential. In other cases, a shrink or press fit may be required.

MACHINERY'S Data Sheet No. 516, June, 1944

Compiled by C. H. Jennings, Welding Engineer
Westinghouse Electric & Mfg. Co.

to establishing his own sales company. LINCOLN E. WALKER, for the last six years assistant general manager, has been appointed general manager, in charge of all the company's activities. He will be in direct charge of the sales department until such time as a new sales manager is selected, and will be assisted by J. H. COYLE, who will also continue to be in charge of the service department.

CLIMAX MOLYBDENUM CO., 500 Fifth Ave., New York 18, N. Y., announces the opening of offices at 624 Fisher Bldg., Detroit, Mich., to handle the company's sales and service work in Michigan, Indiana, and the Toledo district. V. A. CROSBY, who has been associated with the company for the last ten years as metallurgical engineer and sales representative, will be in charge of the new office. W. G. PATTON, who will also be connected with the Detroit office, will have charge of the compilation and publication of technical data on molybdenum steels and irons.

DETREX CORPORATION, Detroit 27, Mich., manufacturer of degreasers, washers, and cleaning compounds, has enlarged its eastern region headquarters, which are now located in the Empire State Bldg., New York City, under the supervision of STANLEY A. HARRIS. The Philadelphia office has been moved to 12 S. 12th St., with WAYNE GADDY in charge. A new branch office for the Indiana territory has been opened at 11 S. Meridian St., Indianapolis, with CHARLES M. MUNNS in charge.

STANLEY W. OSTRANDER has been appointed general manufacturing manager of all the plants of the Pontiac Motor Division of General Motors, Pontiac, Mich. BUEL E. STARR has been made general superintendent in charge of all day manufacturing operations, and DAVID J. DUNLOP general superintendent in charge of afternoon operations.

SCHWARZE ELECTRIC CO. and its STANLEY & PATTERSON DIVISION, Adrian, Mich., which have heretofore operated as a limited partnership, are now known as the FARADAY ELECTRIC CORPORATION. No change has been made in the ownership or operating personnel.

R. W. PFLUG has been appointed manager of the central region territory of the Detrex Corporation, Detroit, Mich., which comprises the states of Michigan, Ohio, Indiana, Kentucky, and West Virginia.

HOLE ENGINEERING SERVICE, Detroit, Mich., has moved to greatly enlarged quarters at 13722 Linwood Ave.

New England

H. C. CLARKE has been appointed district manager of the Pittsburgh branch office of the Bristol Co., Waterbury 91, Conn., manufacturer of automatic control and recording instruments. Mr. Clarke was previously resident sales engineer at the Buffalo office. The Bristol Co. also announces the opening of two new offices—one in the Engineers Bldg., Cleveland, Ohio, and the other in the Citizens State Bank Bldg., Houston, Tex. G. H. GAITES has been appointed regional sales supervisor of the Cleveland and Pittsburgh territories. D. D. AULT, who has been resident sales engineer for the company at Houston for a number of years, will be in charge of the new Texas office.

E. E. CLARK has been made president of the American Screw Co., Providence, R. I., and V. J. RODDY has been advanced to the vice-presidency.

E. E. Clark, Recently Elected President of the American Screw Co.

V. J. Roddy, Newly Appointed Vice-president of the American Screw Co.

W. H. HENSON has been appointed refractories field engineer by the Norton Co., Worcester, Mass. He will make his headquarters in Worcester and will do engineering work in all of the company's refractories territories. Mr. Henson has been with Norton Co. for sixteen years, and for the last thirteen years has been refractories engineer for the New England district. EUGENE A. FISCHER will succeed Mr. Henson as New England refractories engineer. Mr. Fischer has been connected with the research laboratories and the refractories engineering department at Worcester, which will continue to be his headquarters.

New York and New Jersey

HOWARD MAXWELL, manager of the Induction Motor Division of the General Electric Co., Schenectady, N. Y., has resigned after forty-two years of service with the company. Announcement is also made of the resignation of MILTON H. WELLS, designing engineer of the same division, after forty-three years of service. CHARLES J. KOCH has been appointed engineer and FRANK D. PHILLIPS assistant engineer of the Induction Motor Engineering Division.

SAM TOUR, president of Sam Tour & Co., Inc., 65 Pine St., New York 5, N. Y., engineers, metallurgists, and consultants, has been obliged to give up his affiliation with the Barium Steel Corporation, owing to the press of wartime work and post-war planning. The company recently announced the addition of a foundry research unit. FRED J. TOBIAS has joined the staff in the capacity of production engineer.

ALBERT P. LEONARD has been appointed manager of the New York office of the Farrel-Birmingham Co., Inc., succeeding EDWARD S. COE, JR., who has been transferred to the main office of the company at Ansonia, Conn., as assistant to the plant manager. The company is moving its New York office from 79 Wall St., to 3700 Chrysler Bldg.

HAROLD A. ANDERSON has been named eastern district manager of the Austin Co., Cleveland, Ohio, engineers and builders, succeeding J. K. GANNETT, vice-president, who has been appointed director of engineering of the company. Mr. Anderson's headquarters will be at 19 Rector St., New York City.

OWEN D. YOUNG and GERARD SWOPE were, for the twenty-first time, elected chairman of the board and president, respectively, of the General Electric Co., Schenectady, N. Y., at a meeting of the board of directors in New York on April 28.

Fred H. Haggerson, Newly Elected President of Union Carbide and Carbon Corpn.

FRED H. HAGGERSON, vice-president and director of the Union Carbide and Carbon Corporation, New York City, was elected president at a recent meeting of the board of directors, succeeding BENJAMIN O'SHEA, who has been president since 1941 and now becomes chairman of the board. Mr. Haggerson has been associated with the corporation for twenty-five years.

OTTO W. WINTER has been appointed vice-president of the Acme Pattern & Machine Co., Buffalo, N. Y. Mr. Winter has had extensive experience in the tool engineering field. At one time, he was a national president of the American Society of Tool Engineers, and is now national chairman of the Education and Training Committee of the society. Mr. Winter spent some time in Russia as a consultant on machine tool and cutter manufacture to the Soviet Government, and personally engineered the Russian milling cutter design standards.

Otto W. Winter, Recently Appointed Vice-president of Acme Pattern & Machine Co.

WILLIAM P. HEADDEN has been appointed assistant manager of the sales engineering department of the Standard Oil Co. of New Jersey, 26 Broadway, New York City. Mr. Headden has been with the company since 1929.

RALPH R. BROWNING, PAUL P. HUFFARD, and HOMER A. HOLT were elected members of the board of directors of the Union Carbide and Carbon Corporation, New York City, at the annual meeting of stockholders.

YALE & TOWNE MFG. CO., Chrysler Bldg., New York City, has purchased the industrial scale business of the KRON CO., Bridgeport, Conn.

LESLIE L. FREY has been elected vice-president in charge of sales of the General Tool & Die Co., 555 Prospect St., East Orange, N. J. Mr. Frey was formerly director of labor relations and assistant to the general plant manager of the Sperry Gyroscope Co. During 1941 and 1942, he served as chief of the General Machinery Section of the War Production Board.

Ohio

JAMES F. REID, formerly deputy chief of the Alloy Steel Branch of the War Production Board, has been appointed production manager of the Timken Roller Bearing Co., Canton, Ohio. Before obtaining a leave of absence to join the W.P.B., Mr. Reid had been production manager of the Steel and Tube Division of the Timken Roller Bearing Co. He has been connected with the Timken organization for twenty-five years.

DEANE C. CRAWFORD has been promoted to the position of general sales manager of the full finished cap-screw department of the Cleveland Cap Screw Co., Cleveland, Ohio. WILLIAM C. COOKE has been made sales manager of the Aeronautical and Alloy Steel Division, and A. G. THOMAS becomes general purchasing agent.

ALLEN-BRADLEY CO., Milwaukee, Wis., manufacturer of electrical controlling apparatus, announces the removal of its Cleveland offices to 4506 Prospect Road, Cleveland 3, Ohio. R. J. ROY remains in charge as the Cleveland district manager.

R. L. IRVIN has been appointed application manager of the Small Motor Division of the Westinghouse Electric & Mfg. Co., Lima, Ohio. He was formerly industrial manager of the company's northwestern district, with headquarters in Chicago.

R. H. Thielemann, Development Engineer of the Allegheny Ludlum Steel Corporation

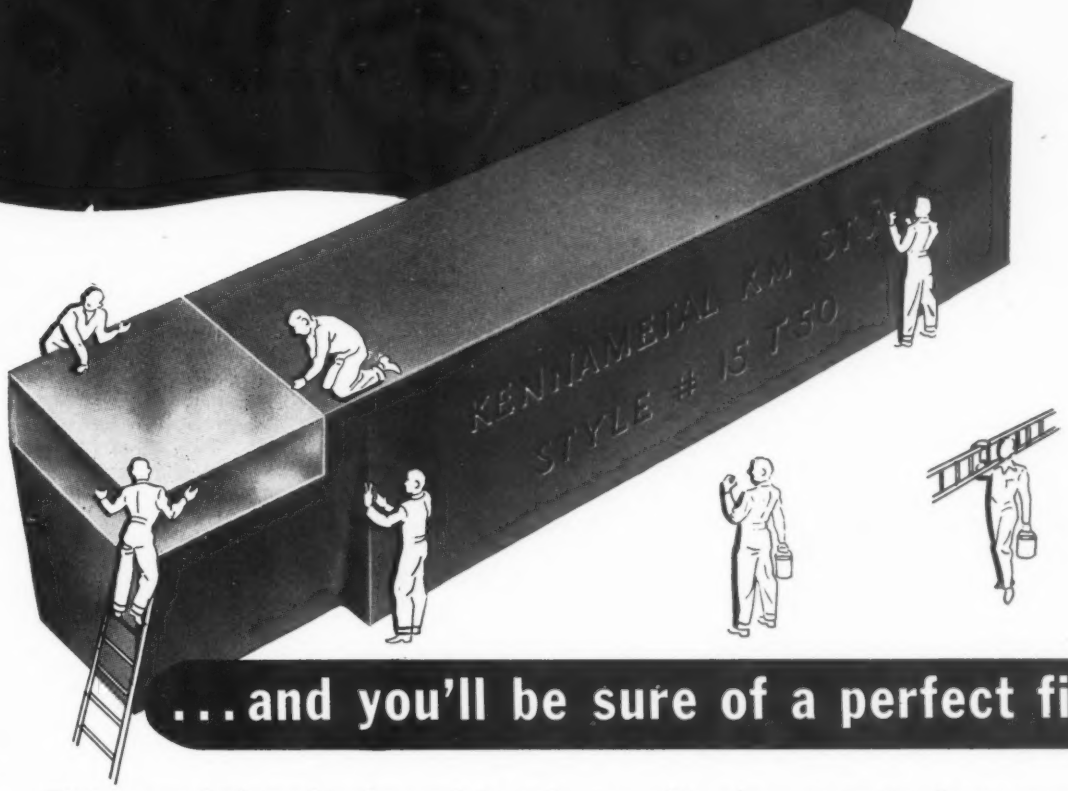
N. H. BRODELL, formerly metallurgical sales engineer with the Copperweld Steel Co., Warren, Ohio, has been appointed Cleveland district manager of the concern.

Pennsylvania

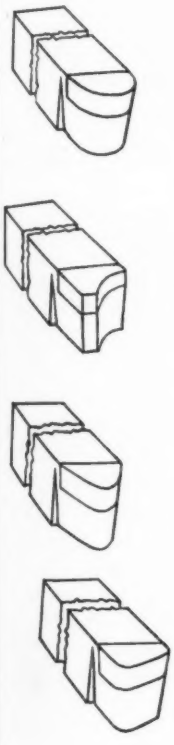
R. H. THIELEMANN has been appointed development engineer of the Allegheny Ludlum Steel Corporation, Brackenridge, Pa. He was formerly associated with the research labora-

Laurence C. Hicks, Associate Director of Research, Allegheny Ludlum Magnetic Products Division

KENNAMETAL-TIPPED



. . . and you'll be sure of a perfect fit



Fitting a carbide tool to the work is a job for specialists—and the skill with which the tool is ground is directly reflected in increased production. Kennametal standard tools will handle the majority of usual metal-cutting jobs, but even if their number were multiplied by ten, there still wouldn't be a sufficient variety. For the tool must be fitted to the work, not the work to the tool.

Our personnel is trained in the art of properly grinding Kennametal-tipped tools. A modified standard tool design produced by us gives the same high performance as a standard tool. There are no thinned-out carbide tip dimensions caused by cutting to required angles. There are no minute accordion cracks resulting from excessive heat generated by "bearing down" to hasten the grinding process.

When we supply the complete tool a simple modification often will cost less than the abrasive wheel alone that would be used up in modifying a standard tool. Even the more complicated modifications can be produced by us more cheaply, for a revision that requires hours of grinding in your shop, takes only minutes in ours. When you need modified standards call on our nearest Field Engineer. Or . . . send us drawing, sketch or blue print with angles and sizes shown. Specify grade of Kennametal or describe work. For complete instructions see our new Tool Manual. Write for a copy of it today.

KENNAMETAL

R CEMENTED CARBIDES

KENNAMETAL *Inc.*, 147 LLOYD AVE., LATROBE, PA.

tory of the General Electric Co. at Schenectady, N. Y. DR. LAURENCE C. HICKS has been appointed metallurgical engineer and associate director of research in the Magnetic Products Division of the corporation. He has been in the research department since 1933.

EDWARD T. NAHILL has been appointed sales manager of the Ace Mfg. Corporation, Philadelphia, Pa. He was formerly connected with the General Electric Co., Schenectady, N. Y.

Edward T. Nahill, Newly Appointed Sales Manager of Ace Mfg. Corporation

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa., recently awarded ten George Westinghouse scholarships, each valued at $1850, to top-ranking seniors in high schools from coast to coast. The winners will attend the College of Engineering of Carnegie Institute of Technology. Scholarships for winners who enter the Armed Services will be held until their return. The ten students, chosen from among 684 candidates in the seventh annual scholarship competition, are as follows: George Baldwin, New Canaan, Conn.; Richard Eschenbach, Williamsport, Pa.; Clifford H. Gower, Austin, Minn.; Thomas J. Hall, Kenton, Ohio; Warrent D. Helmer, Jr., Spokane, Wash.; Richard T. Huntoon, Detroit, Mich.; F. Vincent Prus, Baden, Pa.; Chandler L. Sammons, LaGrange, Ill.; Clark Sloan, Jr., Nashville, Tenn.; and Dale Wright, Amarillo, Tex.

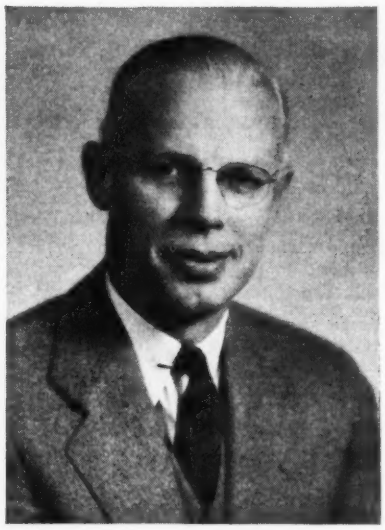
SELAS CO., Erie Ave. and D St., Philadelphia 34, Pa., consulting and manufacturing gas engineers, announce that the name of the company has been changed to SELAS CORPORATION OF AMERICA. The action was necessitated by recent expansions and ramifications of the company's activities. No change has been made in organization, service, or personnel.

W. G. HASSEL has been appointed manager of sales of the Pittsburgh Crucible Division of the Crucible Steel Co. of America, Oliver Bldg., Pittsburgh, Pa. He was formerly manager of the Detroit branch, and has been succeeded in that capacity by W. W. NOBLE, who has been serving as Pittsburgh branch manager; JOHN S. BILLINGSLEY will take Mr. Noble's place at the Pittsburgh branch.

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa., announces the election of the following new vice-presidents: R. A. NEAL, manager of the Switchgear Division at East Pittsburgh; J. K. B. HARE, manager of the central district sales activities; JOHN H. ASHBAUGH, manager of the Electric Appliance Division; and H. H. ROGGE, manager of the company's Washington Government office.

F. W. LEE has been appointed field engineer in the Philadelphia district by the Norton Co., Worcester, Mass., succeeding A. W. MCCUNE, who has joined the U. S. Navy. Mr. Lee was formerly with the research laboratories and the engineering service department of the company at the main office in Worcester.

J. RALPH PATTERSON, vice-president in charge of sales of the Mackintosh-Hemphill Co., Pittsburgh, Pa., and C. HOWARD PAUL, treasurer and assistant to the president, have been elected members of the board of directors.



J. Ralph Patterson, Recently Elected Director of Mackintosh-Hemphill Co.

GORDON G. JOHNSON has been appointed plant manager of the Lycoming Division of the Aviation Corporation, Williamsport, Pa., manufacturer of aircraft engines.

West Virginia and Alabama

DR. STUART D. DOUGLAS, head of Plastics Research, Carbide and Carbon Chemicals Corporation, S. Charleston, W. Va., was awarded the John Wesley Hyatt gold medal for outstanding achievement in the plastics industry at the recent annual conference of the Society of the Plastics Industry. The award, which is sponsored annually by the Hercules Powder Co., carries with it a cash gift of $1000.

TOOL ENGINEERING SERVICE, 505 N. 22nd St., Birmingham 3, Ala., has been appointed representative of the CLEVELAND AUTOMATIC MACHINE CO., Cleveland, Ohio, in the southern states.

Wisconsin

JAMES TATE has been appointed director of marketing of the Dumore Co., Racine, Wis. He was formerly director of industrial and marketing research, and previous to joining the company had been vice-president and general sales manager of the Delta Mfg. Co., of Milwaukee, managing editor of *Popular Homecraft*, and technical editor of *Popular Mechanics*.

ALLEN-BRADLEY CO., Milwaukee, Wis., manufacturer of electrical controlling apparatus, announces the removal of its New York offices to 155 E. 44th St., New York 17, N. Y.

* * *

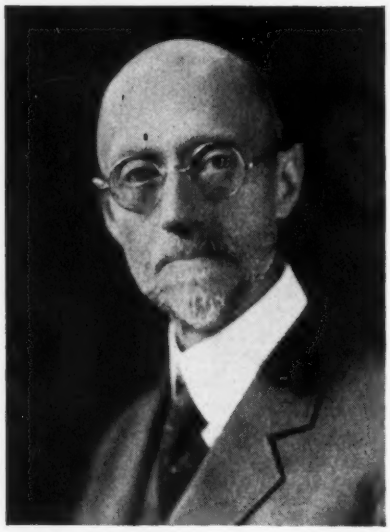
Oakite War Production Conferences

In order to promote the nation's war effort, Oakite Products, Inc., 22 Thames St., New York 6, N. Y., recently organized, for the third year, war production conferences concurrently in New York, Chicago, and Los Angeles. In these conferences, the company's entire field technical service representatives participated, in addition to the mechanical engineering, chemical, and research laboratory staffs. The two-day sessions held in each of the cities mentioned covered industrial cleaning, descaling, derusting, degreasing, and related production and maintenance operations. Of particular interest to metal-working plants were the many new developments in Oakite materials to which reference was made. These are either available at the present time or will be ready to be placed on the market shortly.

* * *

Speed is the important watchword in time of war—cost is secondary; but in post-war years we must once more become cost-conscious.

Obituaries



Bachrach

Charles A. Clarke

Charles Atherton Clarke, founder of the Universal Boring Machine Co., Hudson, Mass., and well known throughout the machinery industries, died in Watertown, Mass., on April 27 at the age of ninety years. Mr. Clarke was born in Woburn, Mass., on September 13, 1854. His parents moved to Worcester when he was three years old, and he received his education in the public schools of that city and of Watertown, in which he later resided. After graduating from high school, he attended the Massachusetts Institute of Technology.

Upon leaving the Institute, he entered the firm of Hill, Clarke & Co., machinery merchants, of which his father was president. When his father died, he became president, and held that position until he disposed of the business. In 1907, he organized the Universal Boring Machine Co. in Hudson, Mass., and started manufacturing the Universal boring machine. He was president of that company until 1941, when he resigned the presidency and became vice-president.

He was married in 1881 to Georgiana Whiting, and lived most of his married life in Newton, Mass. For the last fifteen years, however, he had made his home in Watertown. He was a member of the A.S.M.E. and various other societies and clubs.

Mr. Clarke is survived by a daughter, Carolyn Whiting Goodsell, whose husband is treasurer of the Universal Boring Machine Co., and a daughter, Margaret Collamore Hassett, whose husband was also associated with the Universal Boring Machine Co. until he was called into the Army in 1940. He also leaves four grandsons, three of whom are now in the Navy, and three grand-daughters.

THOMAS B. HOGBEN, manager of the New York office of the L. S. Starrett Co., Athol, Mass., passed away on April 16. Mr. Hogben had been associated with the company for thirty-five years, and was widely known and liked throughout the trade. He had been connected with the Starrett New York office as assistant to William Greene for many years, and was made New York manager about two years ago, when Mr. Greene assumed the position of vice-president and general sales manager at the home office in Athol. The loss of Mr. Hogben will be keenly felt by his many friends.

MICHAEL J. CURTIN, general superintendent and assistant works manager of William Sellers & Co., Philadelphia, Pa., died on May 7 at his home in Philadelphia, aged forty-six years. Mr. Curtin became connected with the company thirty years ago as a machinist. He is survived by his wife, a son, and a daughter.

HENRY A. ZWIERLEIN, chief engineer of The Ajax Mfg. Co., Cleveland, Ohio, died on May 7, following a brief illness, at the age of fifty-five. He joined the Ajax Engineering Department in 1919, and had served as chief engineer for eighteen years.

HARVEY B. BOWER, a vice-president of the Chicago-Latrobe Twist Drill Works, Chicago, Ill., died on May 10 after a brief illness. Mr. Bower had been with the company since 1937, covering the Wisconsin and Minnesota territory.

MICHEL NIGRO, inventor and mechanical engineer, well known in the machine and wire spring industries, died in Worcester, Mass., on April 21. He was sixty-two years old.

Coming Events

JUNE 5-7 — National War Materiel Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Book-Cadillac Hotel, Detroit, Mich. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

JUNE 19-22—Semi-annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the William Penn Hotel, Pittsburgh, Pa. Clarence E. Davies, secretary, 29 W. 39th St., New York 18.

JUNE 26-30—Forty-seventh annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at the Waldorf-Astoria Hotel, New York City. For further information, address American Society for Testing Materials, 260 S. Broad St., Philadelphia 2, Pa.

SEPTEMBER 21-23—Annual meeting of the NATIONAL TOOL AND DIE MANUFACTURERS ASSOCIATION at the Hotel Statler, Buffalo, N. Y. M. W. Rowell, general manager of the Association, Southern Bldg., 15th and H Sts., Washington, D. C.

OCTOBER 2-5—Fall meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Netherland-Plaza Hotel, Cincinnati, Ohio. Clarence E. Davies, secretary, 29 W. 39th St., New York 18, N. Y.

OCTOBER 5-7—Aircraft Engineering and Production Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel Biltmore, Los Angeles, Calif. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

OCTOBER 12-14—Semi-annual meeting of the AMERICAN SOCIETY OF TOOL ENGINEERS at Syracuse, N. Y. Adrian L. Potter, executive secretary, 2567 W. Grand Blvd., Detroit 8, Mich.

OCTOBER 16-20—Twenty-sixth annual meeting of the AMERICAN SOCIETY FOR METALS AND THE NATIONAL METAL CONGRESS, to be held at the Public Auditorium, Cleveland, Ohio. W. H. Eisenman, secretary, American Society for Metals, 7301 Euclid Ave., Cleveland.

NOVEMBER 15-19—THIRD NATIONAL CHEMICAL EXPOSITION in the Chicago Coliseum, Chicago, Ill. M. H. Arveson, chairman, Exposition Committee, American Chemical Society, 330 S. Wells St., Chicago 6, Ill.

NOVEMBER 27-DECEMBER 1—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Hotel Pennsylvania, New York City. Clarence E. Davies, secretary, 29 W. 39th St., New York 18, N. Y.

* * *

Brown Instrument Maintenance and Repair Courses

The Brown Instrument Co. Training School Division, Philadelphia, Pa., is offering industrial maintenance and repair courses without charge to customers of the company who wish to enter students in any of the various classes. The courses started on May 8 and will close on August 4. Coming courses are as follows: June 15 to 22, continuous balance electronic type pyrometer; June 23 to 30, electrically operated automatic control; July 3 to 12, flow meters; July 13 to 20, thermometer-pressure gage-hygrometer; July 21 to 28, air-operated automatic control; July 31, CO_2 and analygraph; August 1 to 4, resistance thermometer and tachometer. All subjects include laboratory practice.

New Books and Publications

TOOL STEELS. By J. P. Gill, R. S. Rose, G. A. Roberts, H. G. Johnstin, and R. B. George. 577 pages, 6 by 9 inches; 277 illustrations. Published by the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. Price, $6.

This authoritative and comprehensive work on tool steels, written by the chief metallurgist of the Vanadium-Alloys Steel Co. and other members of the metallurgical staff, contains a fund of valuable information—both theoretical and practical—on the more commonly used types. No attempt has been made to describe or even list many tool steel compositions of limited manufacture, valuable though they may be for certain applications. The book is intended mainly for the user of tool steels who desires to become better acquainted with the many different types in common use. The material presented should be of value in helping him to solve his tool problems. Chapters are included on manufacturing, classifying, testing, general properties and selection, heat-treatment, and alloying elements. The final chapters discuss specific types of tool steels including chromium and tungsten steels of medium and high alloy content for hot or cold work. Composition, properties, heat-treatment, and applications are given. Wherever possible, available data has been presented in the form of graphs and charts. A complete classified bibliography is appended.

MATERIALS AND PROCESSES. Edited by James F. Young. 628 pages, 5 1/2 by 8 1/2 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, $5.

This book, which is one of the General Electric Series, has been written to present in one volume a broad study of the materials and manufacturing processes employed by the design engineer, and thus to provide information of use in the selection of materials for design. The book is intended for convenient reference and for text-book use. It considers chiefly the materials and processes used in manufacturing electro-mechanical products.

The first part, dealing with materials, covers the following subjects: The Nature of Pure Metals; Alloys; Mechanical Properties of Metals; Iron and Steel; Non-ferrous Metals and Alloys; Heat-Treatment; Corrosion; Magnetic Properties of Materials; Electrical Properties of Materials; Electrical Insulation; and Plastics and Their Molding. The second part, which discusses processes, considers casting processes; powder metallurgy; hot-working processes; cold-working processes; welding and allied processes; machining; gaging, inspection, and quality control; and cleaning, plating, and finishing of metals.

INDUSTRIAL MANAGEMENT. By Asa S. Knowles and Robert D. Thomson. 791 pages, 5 3/4 by 8 1/2 inches. Published by the Macmillan Co., 60 Fifth Ave., New York City. Price, $4.50.

This book has been written for students of industrial management, whether actively engaged in the management of industrial enterprises or learning the fundamentals for the first time. The text and problem materials contained in the book have been used effectively in teaching industrial management to students of business administration, engineering, and liberal arts during the last twelve years. A considerable portion of the contents is based on actual business and consulting experience of the authors.

The text is divided into six parts dealing with the following subjects: Introduction—study of management and budgeting; management of physical property; organization of the physical plant; management of manpower; production control; and cost control. Following each section is a list of questions to test the students' understanding of the material presented, as well as a section of specific problems to be worked out.

THE OXY-ACETYLENE HANDBOOK. 600 pages, 6 by 9 inches. Published by The Linde Air Products Co., Unit of Union Carbide and Carbon Corporation, New York 17, N. Y. Price, $1.50.

This manual on basic oxy-acetylene welding and cutting procedures fulfills a need long felt by both students and experienced welding operators for a complete and authoritative text-book on this subject. The book is of value as a guide for self-instruction, and also as a standard text-book in vocational and trade schools, technical high schools, and engineering colleges. It covers the entire range of the oxy-acetylene process, giving clear instructions for handling all the common commercial metals, together with simple explanations of the fundamental principles of the various methods of depositing and controlling molten metal. In addition to its use as a text-book, it will also be of value as a reference book for engineers, designers, and foremen in shops where oxy-acetylene welding and cutting operations are performed.

AIRCRAFT SHEET-METAL WORK. By Clarence A. LeMaster. 388 pages, 6 by 9 inches. Published by the American Technical Society, Drexel Ave. at 58th St., Chicago 37, Ill. Price, $3.75.

This book is planned to serve as a basic course of instruction for apprentices and other students of aircraft sheet-metal work, and as a "refresher" for mechanics who are more or less experienced in this work. The contents are based on the author's many years of experience as a mechanic and as a teacher of apprentices. The first chapters in the book have to do with safety rules, personal and shop-furnished tools, and blueprint reading. The remaining chapters progress from simple to more complicated processes and operations. Emphasis is always placed on how to do the work—how to rivet, how to weld, how to use a drop-hammer, how to figure bend allowances, etc.

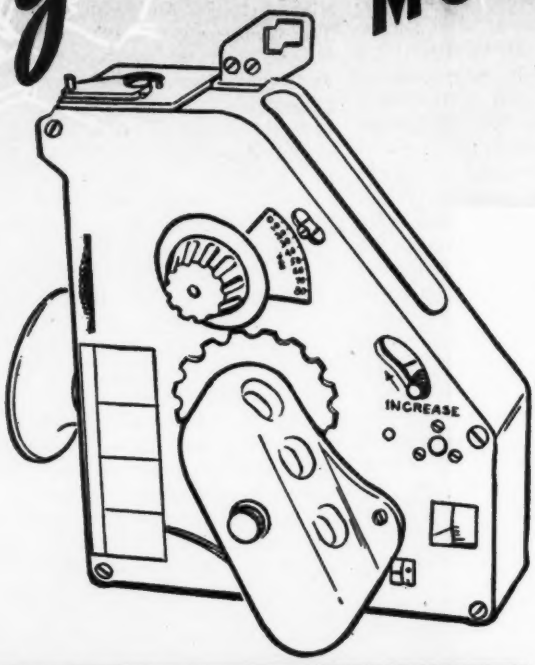
FERROUS METALLURGY, VOLUMES I AND II. By Ernest J. Teichert. Volume I, 484 pages, 5 1/2 by 8 1/2 inches; Volume II, 487 pages, 5 1/2 by 8 1/2 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York City. Price, $4, each volume.

This is the second edition of a comprehensive work on ferrous metallurgy, published in three volumes, which is intended to provide a three-year course of training for persons interested in the iron and steel industries. The first volume contains an introduction to the subject, covering the fundamentals essential to an understanding of the work to follow, and includes the primary processing of iron ore in the blast furnace and the manufacture of cast iron, wrought iron, and crucible steel. The second volume discusses the manufacture and fabrication of steel, covering all the methods commonly employed.

HARTFORD MANUAL ON CONSERVATION AND SALVAGE OF TOOLS AND GAGES. 68 pages, 8 1/2 by 11 inches. Prepared by the Hartford Chapter of the American Society of Tool Engineers, Inc. Available through the Society at 2567 W. Grand Blvd., Detroit 8, Mich. Price, 75 cents.

This manual was planned with the object of presenting various methods of salvaging and reclaiming worn-out or broken tools and gages. It is written in non-technical language and based on proved records of modern shop practice. Tools are being reclaimed for long life by simple economical methods, and gages that are worn beyond dependable usefulness can be restored to a condition rivaling their original appearance and life expectancy. The methods by which these ends are accomplished are described.

Just suppose you asked us to make a MODERN SEXTANT



There's a job! Think of the steps involved. First comes engineering with research, for most successful machines are but the sum of previous efforts—plus improvements. Then a pilot model moving through experimental . . . but we are getting ahead of ourselves.

What we mean to tell you in this ad is that VARD INC. can build units like a Sextant from the drawing board to the finished model in quantity production and never go outside our own plant for anything except raw materials.

Getting back to the pilot model . . . we'd probably make several in experimental with very little tooling. After the design was thoroughly "shaken down," the item would be tooled for production in quantity. We would make a wood pattern for the chassis of the instrument, mould it in sand, and cast it of an aluminum alloy. Other parts would be cast in permanent moulds. Some parts would be stamped.

Inside the Sextant would be gears and ground parts, precision mirrors, and optical glass parts. There would be accurately machined and engraved dials, etc., of metal and plastic. We can do all that.

To make the instrument look right, and stand the weather, its parts would require anodizing, plating, and enameling. We do that, too!

Next, we'd make a wood, plastic, or metal carrying case. And finally—very important—we'd test the Sextant mechanically and optically—on our own equipment.

GEAR CUTTING

OPTICAL GRINDING

In all the hundreds of different operations necessary to complete the pilot models, we have the men and tools to do the job. But here's the thing that makes VARD INC. unique on the Pacific Coast, we also have the equipment and organization that can turn out Sextants in production.

We have the skill accumulated in the production of thousands of aircraft hydraulic and geared parts, navigation instruments, inspection gages and production tools.

If you don't happen to want us to design and build Sextants for you—what do you have that you want to produce in the West—now or after it's all over?

Center your Responsibility and Save Supervision, Time, and Costs!

ARMY E NAVY

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PASADENA 8, CALIF.

...ad & Plug Gages • Snap Gages (VARD or JOHN-SONS Type) • Special Taps • Precision Ground Optical Lenses & Filters • High Fidelity Mirrors

ENGINEERING DRAFTING PROBLEMS. By Kenneth E. Quier. 90 pages, 8 1/2 by 10 3/4 inches. Published by Harper & Brothers, 49 E. 33rd St., New York 16, N. Y. Price, $2.50.

The drafting-room projects presented in this book are designed to develop the ability of the student to read blueprints and to make mechanical drawings in as short a period of time as possible, consistent with a sound working knowledge of the principles and practices employed in engineering. The lay-outs aim to develop resourcefulness and to increase the ability to visualize objects in three dimensions. They are based on practical industrial applications. Any standard text-book can be used to supplement this course.

GUIDE TO METHODS IMPROVEMENT. By Harold B. Maynard and G. J. Stegemerten. 85 pages, 5 by 7 1/2 inches. Published by the McGraw-Hill Book Co., 330 W. 42nd St., New York City. Price, $1.

This book has been prepared to aid those men in American industry whose job it is to search for better manufacturing methods. It especially emphasizes the value of the "questioning attitude," and can be applied to improving existing methods by anyone interested in making improvements, whether he be a trained methods engineer, a progressive foreman, or a worker who wants to make his own work easier to perform.

PLASTIC WORKING OF METALS AND NON-METALLIC MATERIALS IN PRESSES. By E. V. Crane. 540 pages, 5 1/2 by 8 1/2 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, $5.

This is the third edition of a book covering the plastic working of metals and non-metallic materials in presses. It deals with the shearing of metal in dies; bending operations; expanding, contracting, and curling; cold-working of plastic metals; drawing; extrusion; and hot press forging. The book also discusses the characteristics of presses, and describes the molding and forming processes.

PRACTICAL DESIGN OF WELDED STEEL STRUCTURES. By H. Malcolm Priest. 153 pages, 5 1/4 by 8 inches. Published by the American Welding Society, 33 W. 39th St., New York 18, N. Y. Price, $1.

This book deals with the essentials of welding and welded construction concisely and in a readily useful form. Engineers and fabricators should find the book a valuable aid in preparing and executing welded designs. One section deals with the building and bridge codes of the American Welding Society.

PACKAGING OF CARRIAGE, MACHINE, AND LAG BOLTS. 22 pages, 5 3/4 by 9 inches. Published by the United States Department of Commerce, Washington 25, D. C., as Simplified Practice Recommendation R60-43 of the National Bureau of Standards. Price, 5 cents.

METALLIC CARTRIDGES. 9 pages, 5 3/4 by 9 inches. Published by the United States Department of Commerce, Washington 25, D. C., as Simplified Practice Recommendation R62-44 of the National Bureau of Standards. Price, 5 cents.

SYMPOSIUM ON SIGNIFICANCE OF THE HARDNESS TEST OF METALS IN RELATION TO DESIGN. 60 pages, 6 by 9 inches. Published by the American Society for Testing Materials, 260 S. Broad St., Philadelphia 2, Pa. Price, 75 cents.

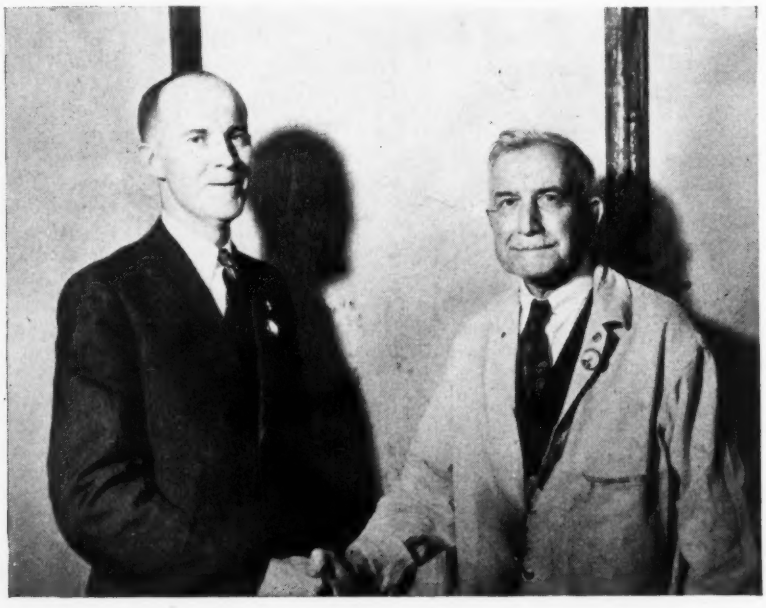
* * *

Buick Makes Production Change-Over

Buick Division of General Motors Corporation is engaged in putting into production two entirely new Pratt & Whitney aircraft engines, one to supersede the present Pratt & Whitney R-1830-43 for Liberator bombers, and the other to power Douglas transports. The new engines are both twin-row Wasps—the R-1830-75 and the R-2000-9—of different dimensions and developing greater horsepower than current types.

"Owing to the absence of interchangeability of parts between the new engines and those we are now building," Harlow H. Curtice, vice-president of General Motors, and general manager of the Buick Division, said, "the production job requires almost complete new tooling without interfering with the output of present engines, which will be carried on at peak rates." To accomplish this, "stand-in" machinery is being placed in the plants for the production of the new engines while the present machines and equipment continue on the current types. Loss of time and valuable production will thus be eliminated—an essential factor in maintaining the Liberator bomber program.

Buick had delivered approximately 45,000 engines to the Army Air Forces by the end of April, all of which are being used in Liberator bombers. Schedules for the calendar year 1944 are 22 per cent higher than the output of 1943.



David Sloan (right), who recently celebrated his eightieth birthday by working his regular eight-hour shift as an instructor at the General Electric's West Lynn Works, is receiving the congratulations of L. T. Callahan, superintendent of the screw machine products manufacturing division. Mr. Sloan, who retired from the company in 1932, was recalled as instructor in 1943, on account of war conditions.

"...SHAVED AERO-GEARS can be made equal to or superior to Ground Gears..."

...as reported in "American Machinist"

Ford currently is finishing 27 P & W aircraft engine gears by "shaving", with the following results:

1. Time cut from 40 minutes to 5 minutes.
2. Eliminates "burnt" teeth.
3. No change in hardness required, but shaved gears are somewhat *harder* than ground gears.
4. Involute error ± 0.00015 inch.
5. Parallelism held within 0.0002 inch.
6. Tooth spacing error, max. 0.0001 to 0.0002 inches.
7. Face runout averaged 0.0005 to 0.0001 inches.

For the complete story, ask for a copy of "Gear Production Highlights", Vol. VIII No. 1

AT ANOTHER plant, this battery of 860-B machines, similar to those used by Ford, is shaving gears for water-cooled aircraft engines, too.

ORIGINATORS of GEAR SHAVING

MICHIGAN TOOL COMPANY

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BUY U.S. BONDS STAMPS

Classified Contents of This Number

Your Progress Depends Upon Your Knowledge of Your Industry